Project Execution Plan
for the
National Synchrotron Light Source II
Project

September 30, 2009

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Project

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Office of Basic Energy Sciences
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ACRONYMS

ACWP	Actual Cost of Work Performed
AE	Architect-Engineer
ALS	Advanced Light Source
ANSI	American National Standards Institute, Inc.
APS	Advanced Photon Source
ARR	Accelerator Readiness Review
ARRA	American Recovery and Reinvestment Act of 2009
ASAC	Accelerator Systems Advisory Committee
ASD	Accelerator Systems Division
ASE	Accelerator Safety Envelope
BCP	Baseline Change Proposal
BER	Brookhaven Executive Round Table
BES	Basic Energy Sciences
BHSO	Brookhaven Site Office
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
BMD	Business Management Division
CAC	Community Advisory Council
CAM	Control Account Manager
CD	Critical Decision
CDR	Conceptual Design Report
CFAC	Conventional Facilities Advisory Committee
CFD	Conventional Facilities Division
CH	Chicago Office
CM	Construction Manager
COR	Contracting Officer's Representative
CPI	Cost Performance Index
DART	Days Away, Restricted, or Transferred
D&D	Decontamination & Decommissioning
DOE	Department of Energy
EA	Environmental Assessment
EAC	Estimate at Completion
EFAC	Experimental Facilities Advisory Committee
EMR	Experience Modifying Rate
ES&H	Environment, Safety and Health
ETC	Estimate to Complete
FONSI	Finding of No Significant Impact
FSAD	Final Safety Assessment Document
FTE	Full Time Equivalent Employee
FY	Fiscal Year
HQ	DOE Headquarters

ISMS	Integrated Safety Management System
IPT	Integrated Project Team
LCLS	Linac Coherent Light Sources
LI	Funding Type – Line Item
LLP	Long Lead Procurement
mA	milli-Amp
meV	milli-electron Volt
M&O	Management & Operating
NEPA	National Environmental Policy Act
NIH	National Institutes of Health
NSF	National Science Foundation
NSLS	National Synchrotron Light Source
NSLS-II	National Synchrotron Light Source II
OECM	Office of Engineering and Construction Management
OMD	Operations Management Division
OP	Funding Type – Operating Expense
OPC	Other Project Costs
OSHA	Occupational Safety and Health Administration
PAC	Project Advisory Committee
PARS	Project Assessment and Reporting System
PCR	Project Change Request
PEP	Project Execution Plan
PSAD	Preliminary Safety Assessment Document
PSO	Program Secretarial Officer
QA	Quality Assurance
QC	Quality Control
R&D	Research & Development
RF	Radio Frequency
RFE	Ready for Equipment
SAD	Safety Assessment Document
SAE	Secretarial Acquisition Executive
SC	Office of Science
SDB	Small Disadvantaged Business
SPI	Schedule Performance Index
SSRL	Stanford Synchrotron Radiation Laboratory
TEAM	Transmission Electron Aberration-corrected Microscope
TEC	Total Estimated Cost
TPC	Total Project Cost
TRC	Total Recordable Cases
U.S.	United States

VE	Value Engineering
WBS	Work Breakdown Structure
XFD	Experimental Facilities Division

NATIONAL SYNCHROTRON LIGHT SOURCE II
PROJECT EXECUTION PLAN

SECRETARIAL ACQUISITION EXECUTIVE PLANS AND CONTROLLED ITEMS

BROOKHAVEN NATIONAL LABORATORY

Steve Dierker 10/27/09

Steven Dierker — Date
NSLS-II Project Director
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Daniel R. Lehman — Date
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Harriet Kung — Date
Associate Director
Office of Basic Energy Sciences

Approved:

Steven Koonin — Date
Under Secretary for Science

CHANGE SYNOPSIS FOR BASE DOCUMENT

Revision	Effective Date	Summary of Change
0	October 17, 2007	Updated Preliminary Project Execution Plan to Project Execution Plan in support of the Critical Decision 2 (CD-2) review and approval process.
1	October 26, 2007	Funding profile corrected in Table 6.1.
2	November 7, 2007	Dr. Dehmer's title updated on signature page. Clarification provided on Key Performance Parameters and Work Breakdown Structure scope completion for External Independent Review.
3	November 16, 2007	Various updates made in response to the External Independent Review and Independent Project Review performed in support of the CD-2 approval. CD-4 and Key Performance Parameters clarified. Change control table clarified. Funding table updated. Appendix D updated. Associate Director of Basic Energy Sciences updated.
4	November 14, 2008	Various updates listed below in preparation for CD-3: 1. Updated signature page to reflect personnel changes. 2. Recognized delegation of authority to approve PEP to US Science. 3. Recognized validity of acquisition strategy for CD-3 w/o further modification. 4. Updated major milestone schedule and funding profile. 5. Recognize FPD authority to assign cost savings to management reserve. 6. Delete all reference to delegation of CD-3 approval to the PSO. 7. Added a tailoring strategy to recognize outstanding design efforts at CD-3. 8. Revised tailoring strategy to recognize that the FPD is now certified level 3 9. Deleted tailoring strategy for joint IPR and EIR. 10. Added BNL APDCF to IPT Core Team

5	September 30, 2009	Various updates listed below: 1. Updated signature page to reflect personnel changes. 2. Recognize ARRA fund being provided for the project 3. Updated major milestone schedule and funding profile.

NATIONAL SYNCHROTRON LIGHT SOURCE II PROJECT EXECUTION PLAN

1. INTRODUCTION

1.1 PEP Structure and Use

The National Synchrotron Light Source II (NSLS-II) is a U.S. Department of Energy (DOE) Major System project that is being carried out to design and build a world-class user facility for scientific research using synchrotron radiation. The Project Execution Plan (PEP) for the NSLS-II Project provides overall guidance to the various project participants on the roles, responsibilities, and management interactions among the DOE Office of Science (SC), the DOE Brookhaven Site Office (BHSO), Brookhaven National Laboratory, and others. The PEP was prepared in accordance with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets* and DOE Manual 413.3-1, *Project Management for the Acquisition of Capital Assets*. The NSLS-II Project is subject to the requirements for a "Major System." The Deputy Secretary of Energy is the Secretarial Acquisition Executive (SAE), and the Director of the Office of Science is the Program Secretarial Officer (PSO) for the NSLS-II Project.

This PEP document presents the plans for project execution, including mission need and justification; project objectives and description; management systems; environment, safety, health, and security; resource planning; transition to operations; project controls (management, the baseline, and change systems); and reporting. The document is organized into discrete sections (i.e., base document and appendices) that correspond to the hierarchical levels of line management for DOE Major System projects. It consists of a base document that establishes the "first principles" for NSLS-II Project execution and specific baseline elements that are normally approved and controlled by the SAE. At CD-1 the SAE delegated authority to approve the PEP to the Under Secretary for Science. Also included are appendices for management, implementation, and control of the project, which are approved and controlled by the PSO, the NSLS-II Federal Project Director (BHSO), and the NSLS-II Project Director, respectively. This hierarchy of documents (base through appendices) provides increasing detail on how the top-level guidelines and controls will be implemented and establishes the specific baseline elements controlled by successive levels of management.

The NSLS-II PEP serves three basic functions. First, it describes the management and project execution processes that have been approved by DOE management. In short, the PEP constitutes the authorizing document for the "way of doing business" on the project. Second, the PEP establishes the project baseline (technical, schedule, and cost) against which project execution will be measured. Changes to project execution will be evaluated in terms of baseline impacts. Through graduated change control authority, appropriate levels of management become involved in decisions regarding project changes. Third, this PEP serves as the primary reference document for all levels of the project team and the primary source document for technical requirements, policies, and procedures for resource allocation, procurement, budgeting and finance, work authorization, management, reporting, reviews, and evaluations.

1.2 PEP Approval and Revisions

Approval of the NSLS-II Preliminary PEP occurred on July 12, 2007 as an element of Critical Decision 1 (CD-1), Approve Alternative Selection and Cost Range. The final NSLS-II PEP is normally approved as an element of CD-2, Approve Performance Baseline, by the SAE. At CD-1, the SAE delegated authority to approve the PEP to the Under Secretary for Science. The PSO, DOE Program, and Laboratory project concurrence will be obtained before submission to the Under Secretary for Science for final approval. This PEP will be reviewed annually and updated to incorporate changes, as required. Revisions will be processed and approved by the corresponding management level (i.e., Under Secretary for Science for base document; PSO, Federal Project Director, and NSLS-II Project Director for Appendices A, B, and C, respectively), with the next higher level being informed of changes. Administrative updates of this PEP to reflect actual budgets, approved baseline change proposals, and/or to incorporate other minor changes are distributed as required.

2. MISSION NEED AND JUSTIFICATION

2.1 Mission Need

Major advances in energy technologies – such as the use of hydrogen as an energy carrier; the widespread, economical use of solar energy; or the development of the next generation of nuclear power systems – will require scientific breakthroughs in developing new materials with advanced properties. Examples include catalysts that can split water with sunlight for hydrogen production, materials that can reversibly store large quantities of hydrogen, materials for efficient power transmission lines, materials for solid state lighting with 50 percent of present power consumption, and materials for reactor containment vessels that can withstand fast-neutron damage and high temperatures. A broad discussion is given in several recent reports, including the Basic Energy Sciences (BES) Advisory Committee Reports *Opportunities for Catalysis in the 21st Century* and *Basic Research Needs to Assure a Secure Energy Future*, the BES report *Basic Research Needs for the Hydrogen Economy*, the Report of the Nanoscale Science, Engineering, and Technology Subcommittee of the National Science and Technology Committee *Nanoscience Research for Energy Needs*, and the Nuclear Energy Research Advisory Committee Report *A Technology Roadmap for Generation IV Nuclear Energy Systems*.

Collectively, these reports underscore the need to develop new tools that will allow the characterization of the atomic and electronic structure, the chemical composition, and the magnetic properties of materials with nanoscale resolution. Needed are non-destructive tools to image and characterize buried structures and interfaces, and these tools must operate in a wide range of temperature and harsh environments. The absence of any tool possessing these combined capabilities was identified as a key barrier to progress in the 1999 BES Report *Nanoscale Science, Engineering and Technology Research Directions*.

In order to fill this capability gap and to further the accomplishment of its mission, the BES program needs a synchrotron light source that will enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. NSLS-II will provide photon beams having ultra-high brightness and flux and exceptional stability. It will also provide advanced insertion devices, optics, detectors, robotics, and a suite of scientific instruments. Together these will provide the capability to characterize materials with a spatial resolution of 1 nanometer (nm) and an energy resolution of 0.1 milli-electron volts (meV) and with sufficient sensitivity to perform spectroscopy on a single atom. No other synchrotron light source worldwide will have these beam characteristics and advanced instrumentation. These unique characteristics of NSLS-II will enable

exploration of the scientific challenges faced in developing new materials with advanced properties. The resulting scientific advances will support technological and economic development in multiple sectors of the economy.

In response to this need, NSLS-II was conceived, Approval of the Mission Need Statement was signed by the PSO on July 19, 2005, and Approval of Critical Decision 0 was signed by the SAE on August 25, 2005.

2.2 DOE Mission

The mission of the Department's Basic Energy Sciences program – a multipurpose, scientific research effort – is to foster and support fundamental research to expand the scientific foundations for new and improved energy technologies and for understanding and mitigating the environmental impacts of energy use. The portfolio supports work in the natural sciences emphasizing fundamental research in materials sciences, chemistry, geosciences, and aspects of biosciences. As part of its strategic mission, BES plans, constructs, and operates major scientific user facilities to serve researchers at universities, national laboratories, and industrial laboratories, as set forth in Public Law 102-486 (Title 42, U.S. Code, Chapter 134 - Energy Policy, Section 13503), which is briefly summarized below.

Mission

The Department shall continue to support a vigorous program of basic energy sciences to provide basic research support for the development of energy technologies. Such program shall focus on the efficient production and use of energy and the expansion of our knowledge of materials, chemistry, geology, and other related areas of advancing technology development.

User Facilities

As part of the program referred to above, DOE shall carry out planning, construction, and operation of user facilities to provide special scientific and research capabilities, including technical expertise and support as appropriate, to serve the research needs of our Nation's universities, industry, private laboratories, Federal laboratories, and others.

NSLS-II supports the BES *scientific mission* by providing the most advanced tools for discovery-class science in condensed matter and materials physics, chemistry, and biology – science that ultimately will enhance national and energy security and help drive abundant, safe, and clean energy technologies. Furthermore, NSLS-II supports the related BES *facilities operation mission* by creating the most advanced storage-ring-based light source to serve the Nation's researchers. Under BES leadership, these facilities have thrived and flourished. The synchrotron light sources have become one of the great success stories of the past 20 years. Once the province of a few hundred specialists, mostly physicists, the BES light sources are now used by more than eight thousand researchers annually from all disciplines and with support from DOE, the National Science Foundation (NSF), the National Institutes of Health (NIH), the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, many other Federal agencies, and foreign countries.

NSLS-II supports elements of DOE's Strategic Plan (2006) and the Office of Science's (SC's) Strategic Plan (2004). The DOE Strategic Plan (2006) contains a Strategic Theme for Scientific Discovery and Innovation that calls for providing a world-class scientific research capability and advancing scientific knowledge in order to protect our national and economic security. Within the framework of the Strategic

Plan, this Strategic Theme translates to Goal 3.1, "Achieve the major scientific discoveries that will drive U.S. competitiveness; inspire America; and revolutionize approaches to the Nation's energy, national security, and environmental quality challenges" and Goal 3.2 "Deliver the scientific facilities, train the next generation of scientists and engineers, and provide the laboratory capabilities and infrastructure required for U.S. scientific primacy."
The SC Strategic Plan expands on the theme of world-class scientific research capacity discussed in the DOE Strategic Plan by specifically recognizing that we are now in the early stages of two remarkable explorations – observing and manipulating matter at the molecular scale (i.e., the nanoscale) and understanding the behavior of large assemblies of interacting components, a subject often referred to as the science of emergent behavior. Scientific discoveries in these two frontiers alone will accelerate our progress toward more efficient, affordable, and cleaner energy technologies.

NSLS-II also supports SC's strategic plan for facilities that was developed in early 2003 and described in *Facilities for the Future of Science: A Twenty-Year Outlook* (2003). As input to that roadmap, the Basic Energy Sciences Advisory Committee considered 15 facility proposals. Of these, only three were given the top science rating. These were the NSLS-II, the Linac Coherent Light Source (LCLS), and the Transmission Electron Aberration-corrected Microscope (TEAM); all three are funded and underway.

Finally, NSLS-II supports the National Nanotechnology Initiative, which was launched in FY 2001 to accelerate the pace of revolutionary discoveries in nanoscale science, engineering, and technology and to facilitate their incorporation into beneficial technologies. In support of this initiative, BES has established five Nanoscale Science Research Centers, each associated with a major synchrotron light source or neutron scattering center.

2.3 Project Goals and Risks

Basic goals of the NSLS-II project are to design, construct, and commission into operation the world's best synchrotron radiation research facility to serve the mission needs of DOE and the scientific community. To complete the construction project (Critical Decision 4), it will be necessary to demonstrate that the accelerator system can deliver beams of high-energy electrons that are stored in the storage ring and that beams of photons produced by insertion devices and bending magnets are delivered to beam transport systems for experimental applications.

The overall NSLS-II design philosophy is to use low-risk technology, requiring minimum research and development, to achieve the facility's baseline performance while, at the same time, having significant upgrade potential. Use of electron storage rings for photon production is a proven technology, and well understood; however, extending that technology to achieve unprecedented levels of brightness, flux, and stability imposes some technical risk. The major procurements require only limited research and development (R&D) and present low technical risk. There are no known technical "show stoppers" in constructing NSLS-II.

R&D will be conducted in two key areas where opportunities exist for and enhanced performance, i.e., demonstrating the ability to fabricate optics that are capable of focusing hard x-rays to 1 nm and demonstrating monochromators and analyzers that are capable of achieving 0.1 meV energy resolution. R&D is underway in these areas, and prototypes will be developed and tested to demonstrate the desired performance.

Reliability, availability, and maintainability will be enhanced through an effective systems engineering effort. There are no known operational constraints or environment, safety, and health (ES&H) issues that would entail significant difficulties.

NSLS-II is a large construction project with a substantial amount of conventional construction. The primary risks associated with conventional construction include design quality, construction management, local market conditions, and construction safety. NSLS-II will address these risk factors as part of the risk management process.

3. PROJECT DESCRIPTION

NSLS-II will be a new synchrotron light source, highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. It will also provide advanced insertion devices, optics, detectors, robotics, and a suite of scientific instruments designed to maximize the scientific output of the facility. Together, these will enable the study of material properties and functions with a spatial resolution of 1 nm, an energy resolution of 0.1 meV, and the ultra-high sensitivity required to perform spectroscopy on a single atom.

The project will design, build, and install the accelerator hardware, experimental apparatus, civil construction, and central facilities required to produce a new synchrotron light source. It includes a third generation storage ring, full energy injector, experimental areas, and appropriate support equipment, all housed in a new building. The facility is designed to meet requirements to ensure high reliability and availability for the user programs and includes support facilities to ensure excellent scientific productivity.

4. MANAGEMENT SYSTEMS

4.1 Organization and Responsibilities

Authority and responsibility for managing the Department of Energy programs and facilities resides with the Secretary of Energy. The Office of Science has been delegated responsibility for comprehensive, long range, basic energy-related research, including state-of-the-art research facilities, crucial to achieving goals described in the Department's Strategic Plan. The Office of Science provides overall program policy and guidance, technical oversight, and budgets for implementing its assigned role. Specific responsibility for design, construction, and operation of NSLS-II is assigned to SC's Office of Basic Energy Sciences (BES).

SC-BES provides funding for the NSLS-II Project directly to BNL via approved financial plans. Day-to-day oversight is provided by SC's Brookhaven Site Office (BHSO). As the Management and Operating (M&O) contractor for BNL, Brookhaven Science Associates (BSA) will be accountable to DOE for carrying out the NSLS-II Project. An Integrated Project Team (IPT) comprised of the DOE, BNL, and other participants, when appropriate, has been established to accomplish this project. BNL has also established the NSLS-II Project Office that will be responsible for all R&D, Title I and II design, fabrication, installation, inspection, commissioning, and overall day-to-day management of the project. This section outlines the project's organization and management approach. The roles and responsibilities of project participants are summarized in the following subsections. A schematic representation of the management arrangement is shown in Figure 4.1.1.

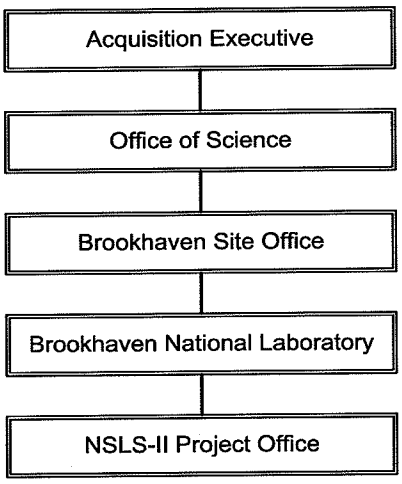

Figure 4.1.1 NSLS-II Project Management Summary

4.1.1 NSLS-II Program Manager

Specific responsibility for design, construction, and operation of NSLS-II is assigned to SC's Office of Basic Energy Sciences (SC-22), with day-to-day program management performed by the NSLS-II Program Manager in the Scientific User Facilities Division (SC-22.3).

The NSLS-II Program Manager's roles and responsibilities are summarized as follows:

- Define programmatic mission requirements and objectives;
- Function as DOE Headquarters (HQ) point-of-contact for project matters;
- Oversee project progress and help organize reviews as necessary;
- Ensure ES&H requirements are implemented by the project;
- Coordinate with other SC Staff offices, HQ program offices, and the Office of Engineering and Construction Management (OECM) as needed to execute the project;
- Budget for funds required to execute the project; and
- Control changes to the project baseline in accordance with this PEP.

Additional information on the SC role in management and execution of the NSLS-II Project can be found in Appendix A.

4.1.2 NSLS-II Federal Project Director

The DOE Headquarters NSLS-II Program Manager implements the NSLS-II Project through the field organization. The manager of BHSO has been delegated line management responsibility and authority for carrying out the NSLS-II project in a manner consistent with this PEP. The NSLS-II Federal Project Director has responsibility and authority for execution of the NSLS-II project as defined in DOE Order 413.3A. The Federal Project Director is supported by a Deputy Federal Project Director. The Deputy Federal Project Director shall assist the FPD in all project duties as assigned and, in the absence of the FPD, shall act with full authority as FPD. Additional support to the NSLS-II Federal Project Director will be provided by BHSO matrix organizations at the level required for project success.

The NSLS-II Federal Project Director carries out the duties of field implementation of the NSLS-II Project. Roles and responsibilities are summarized as follows:

- Lead the Integrated Project Team;
- Serve as the contracting officer's representative for matters pertaining to the NSLS-II Project;
- Ensure that the contractor designs and constructs a facility meeting mission requirements;
- Provide day-to-day oversight of the project and provide direction to ensure its timely execution;
- Function as the DOE Field point of contact for the NSLS-II Project;
- Manage all Integrated Project Team matters requiring coordination with BHSO;
- Maintain effective communications among SC, BHSO, and BNL;
- Monitor, review, evaluate, and report on the performance of the project against the established technical, cost, and schedule performance baseline;
- Participate in project reviews conducted by the NSLS-II Project and by DOE HQ;
- Ensure that the project complies with applicable Environmental, Safety, Security, & Health requirements;
- Prepare and submit budget requests and funding documents to the NSLS-II Program Manager for funds required to execute the project;
- Issue Project Directives, with contracting officer approval, to detail authorized work within funding levels provided in approved Work Authorization and Financial Plan Changes;
- Authorize use of project contingency in accordance with the levels described in this PEP
- Submit key project documents to SC for concurrence/approval;
- Report progress and update the NSLS-II Project data in the DOE Project Assessment and Reporting System (PARS);
- Maintain cognizance of project activities, anticipate potential problems, and take corrective actions to minimize project impacts;
- Control changes within established authority to the project baseline and seek HQ approval for changes beyond the Federal Project Director's authority;
- Ensure adequate facility and construction safety; and provide regular reports to HQ and BHSO on project status; and
- Perform other functions described for the Federal Project Director in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets.*

Additional information on DOE BHSO management and operations is contained in Appendix B.

4.1.3 NSLS-II Project Director

The NSLS-II Federal Project Director implements the NSLS-II Project through the M&O contractor for BNL, Brookhaven Science Associates, which is responsible for overall project coordination, execution, and eventual facility operation. The NSLS-II Project Director has been tasked with line management responsibility and authority for carrying out the NSLS-II Project in a manner consistent with this PEP.

The NSLS-II Project Director is responsible for the overall successful execution of the NSLS-II Project, including:

- Provide executive-level management of the design, construction, and transition to operations of the NSLS-II facility to ensure all mission requirements are fulfilled in a safe, cost-efficient, and environmentally responsible manner;

- Maintain primary responsibility to work with the scientific user community to ensure NSLS-II meets user needs, and provide leadership to the synchrotron community to develop new opportunities in synchrotron science and its applications;
- Exercise full financial authority and accountability as delegated by DOE to develop budgets and control the NSLS-II work within the approved baseline, and control changes to the approved baseline in accordance with established configuration management procedures;
- Manage and direct procurements within the authority delegated by DOE, including the authority to execute and deliver contracts, agreements, teaming agreements, purchase orders, assignments, and instruments and documents of any kind relating to the acquisition, or disposition of products, services, materials, supplies, and equipment relating to and necessary and desirable for completion of the NSLS-II Project;
- Maintain overall responsibility to hire and manage the human resources necessary to complete the NSLS-II Project and ensure an effective transition to operations within the authority delegated by DOE; and
- Maintain a relationship with the foreign synchrotron communities that are designing and operating similar facilities, to keep informed of current progress and developments of potential significance to NSLS-II.

The NSLS-II Project Director is supported by a Deputy Project Director. The NSLS-II Deputy Project Director is responsible for day-to-day project management of the NSLS-II Project, ensuring that the project is completed safely, on time, and within budget. Additional information describing the organization, management responsibilities, and operations of the NSLS-II Project is given in Appendix C.

4.1.4 NSLS-II Integrated Project Team (IPT)

The NSLS-II Project has an Integrated Project Team (IPT) consisting of core members: the Federal Project Director and Deputy, the NSLS-II Project Director and Deputy, and the NSLS-II Program Manager. The IPT is led and organized by the Federal Project Director. The IPT also includes other essential members of the NSLS-II Project Organization and BHSO, as described in the IPT Charter in Section 10.

4.2 Work Breakdown Structure

The NSLS-II Project has been organized into a Work Breakdown Structure (WBS). The WBS contains a complete definition of the project's scope and will form the basis for planning, executing, and controlling project activities. The WBS is structured according to the following level classification:

- WBS Level 1 – NSLS-II Project
- WBS Level 2 – Major subsystem
- WBS Level 3 – Class of component
- WBS Level 4 – Specific component in class
- WBS Level 5 – Specific part or operation required to realize component

The Level 2 WBS is shown in Figure 4.2.1. Elements are defined as specific systems or deliverables (WBS 1.03 – 1.05), Project Management (WBS 1.01), R&D and Conceptual Design (WBS 1.02), or Pre-operations (WBS 1.06), consistent with discrete increments of project work and the planned method of

accomplishment. The WBS, including dictionary and responsible person, to level 3, is contained in Appendix D. Change control is defined in Section 8.

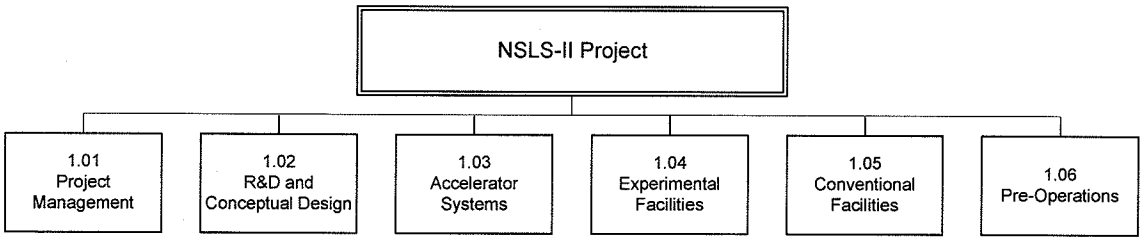

Figure 4.2.1 NSLS-II Work Breakdown Structure, Shown to the Second Level

4.3 Acquisition Strategy

The Acquisition Strategy (AS) evaluated alternatives to NSLS-II and determined that a new facility with NSLS-II capabilities will be capable of satisfying the mission need requirements. The AS also provides an analysis to support the new facility and determines that building NSLS-II at BNL, coupled with the orderly closure of NSLS, delivers the greatest mission capability soonest, at the lowest cost and best value with minimum disruption to existing scientific capabilities.

The acquisition of NSLS-II will be conducted through Brookhaven Science Associates, the BNL M&O contractor. The project makes use of existing BNL staff and facilities and the installation must be carefully coordinated with other research activities at the laboratory. Therefore, it would be extremely challenging for DOE to have a separate contract with another organization to manage this project. BNL has the resources to manage, direct, and execute this project.

Project activities, such as the construction of conventional facilities, will be accomplished to the extent feasible using fixed-priced incentivized subcontracts with selection based on best value, price, and other factors. BNL has also contracted for the services of an Architect-Engineer (AE) firm and for Construction Management support services.

Efforts will be made to encourage the participation of women, minorities, and small/disadvantaged businesses in execution of the NSLS-II Project. Additional information can be found in the Acquisition Strategy for the NSLS-II Project.

The AS for the NSLS-II Project was approved by the Under Secretary for Science on May 10, 2007, with a cost range of $750M to $900M, and was concurred on by OECM on May 24, 2007. The cost range approved at CD-1 is $750M to $925M. The OECM concurrence memorandum to the Under Secretary for Science recommended that the AS be updated when requesting CD-2 approval to (1) specify key project scope parameters that establish requirements for the key conventional and scientific facilities, and (2) designate a permanent certified Federal Project Director. The AS was revised to include this information in support of CD-2 approval. Since CD-2 approval in January 2008, there have been no changes to the project baseline that would necessitate a re-evaluation or update of the Acquisition Strategy.

4.4 Work Authorization

DOE Order 413.3A defines five Critical Decisions – formal determinations or decision points in a project lifecycle that allow the project to proceed to the next phase and commit resources. Each decision constitutes a work authorization for a specific phase of the project. Critical Decisions may be combined or split by appropriate tailoring. The Tailoring Strategy for the NSLS-II Project is contained in Section 9. The Deputy Secretary of Energy serves as the Secretarial Acquisition Executive for the Department and approves site selection and Critical Decisions for the NSLS-II Project, a Major System Project. The Director of the Office of Science serves as the Program Secretarial Officer (PSO) and approves the Mission Need Statement and the Acquisition Strategy. This section describes the basis of each Critical Decision for the NSLS-II Project. Additional details are contained in Section 9.

Critical Decision 0, Approve Mission Need
The Director of the Office of Science approved the Mission Need Statement for NSLS-II on July 19, 2005 and the SAE approved CD-0 on August 25, 2005. Approval of CD-0 authorized preparation of a Conceptual Design Report (CDR), Acquisition Strategy, Risk Management Assessment, and Safety Documentation.

Critical Decision 1, Approve Alternative Selection and Cost Range
Approval of CD-1 authorizes the expenditure of Project Engineering and Design funds to proceed with Title I (preliminary) and Title II (final) design. CD-1 was approved by the SAE on July 12, 2007 and determined that the project will be located at Brookhaven National Laboratory.

Critical Decision 2, Approve Performance Baseline
Approval of CD-2 establishes the technical, schedule, and cost performance baseline for the project. CD-2 is approved by the SAE. CD-2 was approved by the SAE on January 18, 2008.

Critical Decision 3, Approve Start of Construction
Approval of CD-3 authorizes the project to start full-scale construction of NSLS-II. CD-3 is approved by the SAE. CD-3 was approved by the SAE on January 9, 2009.

Critical Decision 4, Approve Project Completion
Project completion (CD-4) will be accomplished when the scope defined in the WBS Dictionary (the current version of which is contained in Appendix D) has been delivered and demonstrated to be functioning by achieving the Threshold Key Performance Parameters at Project Completion listed in Table 4.4.1. The KPPs indicate completion of the construction project and will enable the capability of this synchrotron facility to ultimately achieve spatial resolution of about 1 nm and energy resolution of about 0.1 meV. Demonstration of these resolutions is not expected at project completion and it is expected that additional effort beyond project completion will be needed in order to achieve them.

The WBS Dictionary is under change control as defined in Section 8. Prior to CD-4, a period of commissioning and performance testing for NSLS-II will be completed as technical systems and facilities are installed. When the scope defined in the WBS Dictionary has been delivered and demonstrated to be functioning by achieving the Threshold Key Performance Parameters at Project Completion and has been certified to operate properly and safely, the project and DOE managers will recommend facility acceptance and approval of CD-4. CD-4 is approved by the SAE.

Table 4.4.1 NSLS-II Threshold Key Performance Parameters at Project Completion

Key Parameters	Performance
Accelerator Facilities	
Electron Energy	3.0 GeV
Stored Current	25 mA
Conventional Facilities	
Building Area	> 340,000 GSF
Experimental Facilities	
Beamlines installed and ready for commissioning with X-ray beam	6

4.5 Project Summary Schedule

A milestone schedule to construct NSLS-II is shown in Table 4.5.1.

Table 4.5.1 NSLS-II Milestone Schedule

Major Milestone Events	Schedule
CD-0, Approve Mission Need	8/25/05 (actual)
CD-1, Approve Alternative Selection and Cost Range	7/12/07 (actual)
CD-2, Approve Performance Baseline	1/18/08 (actual)
CD-3, Approve Start of Construction	1/9/09 (actual)
CD-4, Approve Project Completion	3rd Quarter, FY2015

4.6 Financial Management

4.6.1 Budgeting

Annual budget requests adequate to support the project baseline will be submitted each year. These requests will address operating, capital equipment not related to construction, and line item funds; will include an appropriate contingency; and will be the interdependent set of estimates required to manage and maintain the total project cost (TPC). Funds for constructing and operating NSLS-II will be directed to the NSLS-II Project within BNL.

4.6.2 Life-Cycle Cost

The project life-cycle cost reflecting the TPC for design and construction, operation for the 30-year design life, and eventual decommissioning, is estimated to be $4 billion. The life-cycle cost is dominated by the annual operating costs for a 30-year facility lifetime.

4.7 Quality Assurance

A project quality assurance (QA) program in accordance with DOE requirements has been implemented.

4.8 Project Monitoring, Assessment and Reviews

Real-time monitoring of the NSLS-II Project will occur through established mechanisms among project participants. Progress reviews of the project will be conducted by SC, typically at semiannual intervals, with results of these reviews provided to the Under Secretary for Science. Quarterly Progress Reviews will be conducted between the Under Secretary for Science and the Federal Project Director. Formal project reporting, including monthly data submissions into the DOE Project Assessment and Reporting System (PARS), is in effect for the duration of the construction project, in accordance with the reporting requirements identified in DOE O 413.3A and this PEP. The monthly PARS report will also serve as the basis for the NSLS-II Project's input to the OECM Monthly Project Status report to the Deputy Secretary. In addition, the Federal Project Director and the NSLS-II Project Director will conduct monthly status meetings as a regular, comprehensive assessment of the NSLS-II Project status.

Peer and independent reviews are an excellent management tool and serve to verify the NSLS-II Project's mission, organization, development, baseline and progress. Several types of external reviews are also required by DOE O 413.3A. External Independent Reviews and Independent Project Reviews will performed by OECM and SC's Office of Project Assessment in support of approval of CD-2 and CD-3. The division of responsibility between the two organizations is detailed in the NSLS-II Project Tailoring Strategy in Section 9. Design Reviews are an integral part of the project and are performed by individuals external to the project. For the NSLS-II Project, design reviews are organized by NSLS-II Project Director in coordination with the Federal Project Director. Other peer reviews are performed on special topic areas on an as-needed basis and are organized by the NSLS-II Project Office.

5. ENVIRONMENT, SAFETY, HEALTH, AND SECURITY

5.1 National Environmental Policy Act

In compliance with the National Environmental Protection Act (NEPA) and its implementing regulations (10 CFR 1021 and 40 CFR 1500-1508), an Environmental Assessment (EA) was prepared to evaluate the potential environmental consequences of constructing and operating NSLS-II. The EA analyzed the potential environmental consequences of the facility and compared them to the consequences of a No Action alternative. The assessment included detailed analysis of all potential environmental, safety, and health hazards anticipated as the design, construction, and operation of the facility progresses. The EA found that there would be no significant impact from the construction and operation of the proposed facility and determined that an Environmental Impact Statement was not required. A Finding of No

Significant Impact (FONSI) was approved and made available to the general public and project stakeholders.

5.2 Project Safety

The safety and security of all staff, guests, contractors, vendors, and the environment is a primary priority at Brookhaven National Laboratory and for the NSLS-II project management. It is the expectation that all Project staff and contractors will plan, manage, and execute their respective duties consistent with the requirements of the BNL Integrated Safety Management Systems and ensure that the facility is designed, constructed, and operated in a safe and environmentally sound manner.

Expectations for Environment, Safety, and Health (ES&H) performance have been established in the ES&H Plan for the NSLS-II. All work associated with this project will be conducted in a manner that ensures protection of the workers, the public, and the environment. Policies and requirements to ensure implementation of these expectations will be established and communicated to all staff, contractors, and vendors.

5.3 Waste Minimization and Pollution Prevention

An important objective of the NSLS-II Project is to minimize the amount of waste generated during the full facility life cycle (construction, operation, and decommissioning). This will be achieved through design choices that reduce the kinds and amounts of waste, by recycling materials to the extent feasible, and proper treatment or pretreatment of waste streams. Close interaction with the BNL Environmental and Waste Management Services Division during design, construction, and commissioning will ensure that opportunities to reduce waste generation are identified and acted on and will ensure compliance with Federal regulation. In addition, the NSLS-II management will establish an environmental management system based on ISO 14001 criteria to strengthen its environmental programs and ensure that waste minimization and pollution prevention receive high priority throughout the duration of the project.

5.4 Construction/Industrial Safety

Safety of the workforce, safe transport and installation of components, and safe checkout and startup of the facility are prime project goals. To achieve these goals, safe working conditions and practices are an absolute requirement for all staff and contractors. Project participants will enforce safety requirements and rules. Management support for these goals and expectations will be communicated regularly and often to all staff and contractors. It is essential that safety be fully integrated into the project and be managed as tightly as quality, cost, and schedule.

The project's objective will be to prevent accidents and to actively seek an injury-free work environment through a rigorous construction safety program. In consultation with DOE, the NSLS-II Project will establish "Best in Class" safety goals as a measure of performance during construction. Consistent with guidance established by the Office of Science for large construction projects, the Total Recordable Case (TRC) Rate and Days Away, Restricted or Transferred (DART) rate will be tracked and compared to the Bureau of Labor Statistics (BLS) injury data for construction work. Project rates will be expected to remain lower than the 25th percentile of the BLS construction injury data for each year of construction. In addition, all safety incidents and near-misses will be examined to determine the lessons learned and use each as a valuable training and learning tool to prevent recurrence.

Management support for safety will be a key issue in the selection process for all contractors and will be emphasized in the pre-solicitation discussions and throughout the selection process. In addition, the prior safety performance of the contractors will be a part of the evaluation process. For example, satisfactory OSHA injury rates and an Experience Modifying Rate (EMR) of less than 1 will be criteria in the selection process. A Project ES&H plan that establishes and clarifies safety expectations will be included in all bid packages. The NSLS-II Construction Project ES&H Plan has been developed and builds on the lessons learned from the recent construction projects at BNL as well as the very successful DOE Spallation Neutron Source Project.

All subcontractors and lower-tier contractors will be required to develop a Contractor Health and Safety Plan for NSLS-II management approval. The Contractor Health and Safety Plan must address the requirements in the NSLS-II Construction Project ES&H Plan and must create an effective Integrated Safety Management System at the work site. This plan will identify the hazards associated with the work to be performed by the contractor and will describe the controls that will be used to ensure that the work can be performed safely. Contractors must also assure adequate training of personnel and provide work planning to ensure understanding and implementation of all controls. Contractors will be held accountable to their Health and Safety Plan through a safety incentives provision in their contract. Noncompliance with their Health and Safety Plan or other poor safety performance will result in reductions in their safety incentive awards.

Active oversight of ongoing work will be performed to ensure implementation of the Health and Safety Plan work requirements, including field oversight from Contractor safety personnel, as well as from the Construction Manager (CM). In addition, the NSLS-II ES&H staff will include a construction safety inspector to provide ongoing field presence. Regular senior management presence at the work site will provide further emphasis on a strong safety culture and support for compliance with safety requirements.

Through these provisions, a "Best in Class" safety program will be achieved during the construction of NSLS-II. Such a program is essential to the safety of the workers as well as the successful completion of the project.

5.5 High Performance Sustainable Building Considerations

The NSLS-II Project incorporates high performance sustainable building considerations in accordance with the guiding principles of Executive Order 13423. The NSLS-II facility will incorporate a wide range of sustainable strategies and objectives throughout the design and construction process while meeting the functional requirements of an advanced technology facility and creating a workplace that is environmentally friendly, energy-efficient, and both healthy and pleasant to be in. The NSLS-II facility will be designed to achieve a minimum Leadership in Energy and Environmental Design (LEED) certification level of LEED Certified and higher if possible.

6. RESOURCE PLANNING

6.1 Funding Profiles

Table 6.1 shows the planned funding profile for the NSLS-II Project based on the Performance Baseline Total Project Cost of $912 million, which is burdened and escalated.

Table 6.1 Planned Funding Profile for the NSLS-II Project ($M)

($M)	PY	FY09	FY10	FY11	FY12	FY13	FY14	FY15	Total
OPC*	47.8	10.0	2.0	1.5	7.7	24.4	22.4	5.0	120.8
TEC PED	32.7	27.3	0.0	0.0	0.0	0.0	0.0	0.0	60.0
TEC Construction	0.0	66.0	162.5	252.9	166.1	57.4	26.3	0.0	731.2
TPC (initial profile)	80.5	103.3	164.5	254.4	173.8	81.8	48.7	5.0	912.0
ARRA fund revision		+150.0	-23.5	-101.3	-14.7	-10.5			
TEC Construction (revised profile)**		216.0	139.0	151.6	151.4	46.9	26.3	0.0	731.2
TPC (revised profile)***	80.5	253.3	141.0	153.1	159.1	71.3	48.7	5.0	912.0

* Other Project Costs (OPC) include Conceptual Design, Research and Development and Pre-Operations.
** Total Estimated Cost (TEC) Construction profile revised to reflect inclusion of ARRA fund.
*** Total Project Cost (TPC) includes TEC PED, TEC Construction, and OPC.

6.1.1 American Recovery and Reinvestment Act (ARRA)

Table 6.1 includes $150M of construction funds in FY09 that were provided by the American Recovery and Reinvestment Act of 2009. ARRA provided funds earlier than planned in the baseline but did not augment the Total Project Costs. ARRA funds are mostly planned for civil construction and will ensure timely delivery of NSLS-II in a cost effective manner with reduced cost and schedule risks. The overall schedule for the ring building completion will not be accelerated, however, ARRA funds allowed re-ordering of the work sequence with a six month acceleration of the injection building completion. In addition, Recovery Act funds will accelerate completion of the Laboratory Office Buildings (LOBs) by fifteen months. Acceleration of the injection building allows for earlier installation and commissioning of the injector which had been close to critical path. This addition of schedule float will significantly reduce the schedule risk for the accelerator. Acceleration of the LOBs' allows the project to maximize cost advantage of the depressed construction market although this cannot be calculated precisely. Aside from costs associated with risk reduction, there is no measurable reduction in direct costs resulting from these accelerations.

7. TRANSITION TO OPERATIONS

7.1 Facility Startup

Checkout, test, acceptance, and pre-operations of facility components will be addressed by appropriate planning for all aspects of bringing the individual components on line to support integrated operation of the complete facility, to address the operating procedures and maintenance requirements of the facility, and to provide the necessary technical personnel and operator training and qualification.

7.2 Lessons Learned

As the NSLS-II Project is implemented, lessons learned of "what went right" and "what went wrong," as well as insights into what might have been done better, will be studied and documented.

8. PERFORMANCE BASELINE AND CHANGE CONTROL

An essential element of project management systems is the control of changes to the performance baseline and the implementation approach. This objective is carried out through a hierarchy of change control levels, with progressively structured authority for approval and disapproval of changes. The four DOE control levels follow.

Level 0: There are no level 0 thresholds for changes within the performance baseline. The SAE and the Under Secretary for Science control deviations to the performance baseline as defined in Table 8.1. The SAE also controls site selection. Additional details are contained in the NSLS-II Project Tailoring Strategy in Section 9.0.

Level 1A: DOE Director, Office of Science controls the Acquisition Strategy and changes exceeding threshold levels as defined in Table 8.2.

Level 1B: DOE Director, Office of Basic Energy Sciences (BES) controls changes exceeding threshold levels as defined in Table 8.2.

Level 2: NSLS-II Federal Project Director controls changes exceeding threshold levels as defined in Table 8.2.

Level 3: NSLS-II Project Director controls changes exceeding threshold levels as defined in Table 8.2.

Thresholds for changes that modify the Performance Baseline (i.e., Deviations) are listed in Table 8.1. Change control thresholds are listed in Table 8.2 for changes that do not modify the performance baseline.

Table 8.1 Thresholds for Performance Baseline Deviations

Change Element	Secretarial Acquisition Executive (SAE)	Under Secretary for Science (PSO if delegated)
Technical Scope	Site: Brookhaven National Laboratory Any change in scope and/or performance that affects mission need requirements and the Threshold Key Performance Parameters at Project Completion listed in Table 4.4.1, or is not in conformance with current approved project data sheet.	Any change in scope and/or performance that affects mission need requirements and the Threshold Key Performance Parameters at Project Completion listed in Table 4.4.1, or is not in conformance with current approved project data sheet.
Schedule	6 month or greater increase (cumulative) in the original project completion date (i.e., CD-4) referenced in Table 4.5.1.	Less than 6 month increase (cumulative) in the original project completion date (i.e., CD-4) referenced in Table 4.5.1.
Cost	Increase in excess of $25M or 25% (cumulative) of the original CD-2 cost baseline as shown in Table 6.1.	Increase of less than $25M or 25% (cumulative) of the original CD-2 cost baseline as shown in Table 6.1.

Table 8.2 Thresholds for Routine Project Changes

Change Element	Level 1A – Director, Office of Science	Level 1B – Director, Basic Energy Sciences	Level 2 – Federal Project Director*	Level 3 – NSLS-II Project Director
Technical Scope	Approval only required in case of Deviation as defined in Table 8.1 above.	Any change in scope and/or performance that affects the Threshold Key Performance Parameters at Project Completion listed in Table 4.4.1. Any change at WBS Level 2 that impacts the scope performance as referenced in Appendix D.	Any change at WBS Level 3 that impacts the scope performance as referenced in Appendix D.	Any change at WBS Level 4 and below that impacts the scope performance as referenced in Appendix D.
Schedule		Any change to a 1B milestone as referenced in Section A4.5 in Appendix A of this PEP.	Any change to a Level 2 milestone as referenced in Section B4.5 in Appendix B of this PEP.	Any change to a Level 3 milestone as referenced in the Baseline schedule.
Cost		Any change to TEC or OPC. The smaller cumulative change of ≥ $50M or 50% to each level 2 WBS element budget at completion (BAC).**	Any change to TEC or OPC. The smaller cumulative change of ≥ $10M or 50% to each level 3 WBS element BAC.**	Changes to cost below the Level 2 threshold. Approval of management reserve use.***

* Any contingency usage will require the approval by the DOE.

** After the cumulative threshold has been reached and the next higher change authority has been notified and has approved the changes, the cumulative cost thresholds will reset.

*** The Federal Project Director, with the concurrence of the Director, Office of Basic Energy Sciences, may assign a portion of the contingency to the NSLS-II Project Director for use as management reserve. The FPD may also assign cost savings from within the performance baseline to management reserve.

9. NSLS-II PROJECT TAILORING STRATEGY

DOE Order 413.3A allows for the development of a Tailoring Strategy for each project. Tailoring is an essential element of the acquisition process and must be appropriate considering the risk, complexity, visibility, cost, safety, security, and schedule of the project. The requirements of the Order are to be applied on a tailored basis as appropriate to the project. Tailoring is subject to the Acquisition Executive's approval and is identified prior to the impacted Critical Decision and approved as early as possible. In the Tailoring Strategy, the Federal Project Director will identify those areas a project plans to tailor and an explanation/discussion of each tailored area. This Tailoring Strategy was initially developed to support approval of CD-1 and has been updated to support approval of CD-2. Tailoring does not imply the omission of essential elements in the acquisition process that are necessary for all projects, or other processes that are appropriate to a specific project's requirements or conditions. Moreover, concerning matters relating to integrating safety into the early design of a facility, it is not anticipated that tailoring or modification of the acquisition process would be desirable.

This tailoring strategy was developed by the Integrated Project Team under direction of the Federal Project Director. The resultant plans and actions incorporate lessons learned from successful large-scale Office of Science (SC) projects over the past 20 years, comments from SC peer review committees, and advice of senior SC managers.

The key Tailoring areas for the NSLS-II Project are as follows:

(1) **Project Execution Plan (PEP):** This PEP presents the plans for project execution, including mission need and justification; project objectives and description; management systems; environment, safety, health, and security; resource planning; transition to operations; project controls (management, the baseline, and change systems); and reporting. The document is organized into discrete sections (i.e., base document and appendices) that correspond to the hierarchical levels of line management for DOE Major System projects. It consists of a base document that establishes the "first principles" for NSLS-II Project execution and specific baseline elements that would normally be approved and controlled by the Secretarial Acquisition Executive (SAE). At CD-1, the SAE delegated authority to approve the PEP base document to the Under Secretary for Science. Also included are appendices for management, implementation, and control of the project, which are approved and controlled by the Program Secretarial Officer (PSO), the NSLS-II Federal Project Director (BHSO), and the NSLS-II Project Director, respectively. This hierarchy of documents (base through appendices) provides increasing detail on how the top-level guidelines and controls will be implemented at the various levels and establishes the specific baseline elements controlled by successive levels of management. In addition, Appendix D contains more detailed project scope information, i.e. the work breakdown structure and dictionary.

The PEP will be reviewed annually and updated to incorporate changes, as required. Revisions will be processed and approved by the corresponding management level (i.e., US for Science for base document; PSO, Federal Project Director and NSLS-II Project Director for Appendices A, B, and C, respectively), with the next higher level being informed of changes. Administrative updates of the PEP to reflect actual budgets, approved baseline change proposals, and/or to incorporate other minor changes are distributed as required.

The structure and organization of the PEP is discussed in Section 1 of the base document.

(2) **Change Control Thresholds:** There are no level 0 thresholds for changes within the performance baseline. The Office of Science is responsible for implementing the Department's scientific objectives and is best qualified to determine the top level changes in scope, cost, and schedule within the performance baseline. A performance baseline deviation occurs when the approved performance, scope parameters, cost, or schedule cannot be met. The SAE and the Under Secretary for Science control deviations to the performance baseline as defined in Table 8.2. The SAE also controls site selection.

(3) **Quarterly Project Reviews:** DOE O 413.3A allows the SAE to delegate participation in Quarterly Project Reviews. Quarterly Progress Reviews may be conducted between the Under Secretary for Science and the Federal Project Director or SC Headquarters program staff with the SAE.

(4) **Critical Decision 3**, Approve Start of Construction: DOE Order 413.3A requires that design and engineering be "essentially complete" prior to CD-3. In order to maximize resource utilization, the project will commence construction with some design efforts ongoing. The program accepts the additional risks of proceeding with construction provided these risks are understood and managed by

the project within baseline contingency limits. The project will document the status of the design efforts at CD-3 in a "Final Design Plan" to be submitted to DOE. That plan along with the project risk registry documenting the risks of the outstanding design, will serve to demonstrate to the program the acceptability of CD-3 approval without an "essentially complete" design. Throughout the project execution phase, the program will request assistance to conduct focused design reviews by scientific community peers to assure the outstanding designs at CD-3 are completed in a timely fashion with sufficient quality/details to ensure they fully support the baseline performance, cost and schedule.

(5) **Critical Decision 4**, Approve Project Completion: Project completion (CD-4) will be accomplished when the scope defined in the WBS Dictionary (the current version of which is contained in Appendix D) has been delivered and demonstrated to be functioning by achieving the Threshold Key Performance Parameters at Project Completion defined in Table 4.4.1. The WBS Dictionary is under change control as defined in Section 8. Prior to CD-4, a period of commissioning and performance testing for the NSLS-II will be completed as technical systems and facilities are installed. An NSLS-II Commissioning Plan will be prepared to ensure that NSLS-II systems are integrated and functioning as designed and meet the Threshold Key Performance Parameters at Project Completion. When the scope defined in the WBS Dictionary has been delivered and demonstrated to be functioning by achieving the Threshold Key Performance Parameters at Project Completion and certified to operate properly and safely, the DOE Program/Project team will conduct a Project Completion Review to meet the objective of the "operational readiness review" described in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets* (not to be confused with the Operational Readiness Review specified in DOE Order 420.2B, *Safety of Accelerator Facilities*). This review and completion of the performance tests will be documented in a Project Completion Report, which will serve as the basis for a request to the SAE for approval of CD-4. Approval of CD-4 completes the construction phase of the project, and NSLS-II will enter the normal research operations phase.

(6) **Long Lead Procurements (LLP):** The preparation of the conceptual design and preliminary baseline range resulted in the identification of potential long lead procurement items that, if pursued, would reduce project costs and mitigate schedule risk for the entire project. In order to maintain flexibility, approval of Long Lead Procurements with values less than $25 million is delegated to the PSO (i.e., the Director, Office of Science). Under this authority, conditional approval was granted in June 2008 to proceed with LLP to begin early site preparations early in FY09 not to exceed $1.5 million.

(7) **Federal Project Director (FPD):** The NSLS-II Project requires a Federal Project Director certified at level 4, per DOE G 361.1A. The Brookhaven Site Office completed two recruiting actions but was not successful in finding a qualified candidate certified at level 4 to fill the position. The Deputy Manager of the Brookhaven Site Office was assigned to the FPD position and was certified at level 3. The FPD will continue development activities to attain level 4 certification at the earliest opportunity.

10. INTEGRATED PROJECT TEAM CHARTER

The NSLS-II Project has an Integrated Project Team (IPT) that has been operating under a Charter originally approved by the Director, Office of Basic Energy Sciences. This section has been updated from the original charter to reflect current IPT practices. The IPT Charter has been added to the PEP base document to allow the SAE to approve the IPT Charter as part of the PEP.

10.1 Purpose

This Charter defines and integrates the roles and responsibilities of the IPT, which is responsible for the completion of the NSLS-II Project for the DOE Office of Science (SC). By its nature, the Charter constitutes the agreement among the IPT members as to how the project baseline will be managed, the coordination and cooperation that will be afforded all team members and the dedication of each team member to bring the project success. The charter embodies the three basic tenets of an IPT: the Federal Project Director is in charge of the project; the IPT is advisory and an implementing body to the Director; and direct communication is expected as a means of exchanging information and building trust.

This IPT Charter has been prepared in accordance with the requirements of DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and its implementation manual, DOE M 413.3-1, *Project Management for the Acquisition of Capital Assets*. The charter will be in effect until officially rescinded and will be updated as needed to reflect any changes.

10.2 Project Description

NSLS-II will be a new synchrotron light source, highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. It will also provide advanced insertion devices, optics, detectors, robotics, and a suite of scientific instruments that will enable the study of material properties and functions down to a spatial resolution of 1 nm, energy resolution of 0.1 meV, and with ultra-high sensitive capability to perform spectroscopy on a single atom.

The objective of the NSLS-II Project is to deliver a research facility to advance fundamental science and have the capability to characterize materials at the nanoscale. It will also be a user facility made available to other researchers from universities, industries and other laboratories.

The project scope includes the design, construction, and installation of the accelerator hardware, civil construction, and central facilities required to produce a new synchrotron light source. It includes a third generation storage ring, full energy injector, experimental beamlines and optics, and appropriate support equipment, all housed in a new building.

10.3 Integrated Project Team

DOE uses an integrated project teaming approach for management of projects, especially the acquisition of capital assets. The Integrated Project Team, organized and led by the Federal Project Director, is an essential element in DOE's acquisition process and is used during all phases of a project's life cycle. This team consists of professionals representing diverse disciplines with the specific knowledge, skills, and abilities to support the Federal Project Director in successfully executing the project. The IPT for the NSLS-II Project will consist of members from both DOE and the contractor, BSA. The team membership will change as a project progresses from initiation to closeout to ensure the necessary skills are always represented to meet project needs.

The IPT will:

- Support the Federal Project Director.
- Develop and/or participate in project planning, baseline development and contracting.

- Ensure all project interfaces are identified, completely defined, and managed to completion.
- Identify and define appropriate and adequate scope, schedule and cost parameters.
- Support the preparation, review, and approval of project documentation including Critical Decision packages.
- Review and assess project performance and status against established performance parameters, the baseline, milestones and deliverables.
- Identify and resolve issues.
- Plan and participate in project reviews, assessments, and appraisals as necessary.
- Review and evaluate baseline and funding change requests and support the Change Control Boards as requested.
- Plan and participate in operational readiness assessments.
- Support the preparation, review, and approval of project completion and closeout documentation.

Each member is responsible for supporting project performance, scope, schedule, cost, safety, and quality objectives; for identifying and meeting project and contract commitments; and for maintaining communication with other IPT members.

The IPT is grouped into three areas (i.e. Executive, Core and Support) with specific expectations on their responsibilities.

10.3.1 Executive Members

These members provide executive leadership to the NSLS-II Project and champion its success in their respective organizations. The Executive Members consist of the Director of the SC Office of Basic Energy Sciences (BES), the Manager of the SC Brookhaven Site Office (BHSO) and the BNL Director. These members are responsible for ensuring that the necessary resources and support are provided and that needed approvals are provided in a timely manner.

10.3.2 Core Members

The Core Team provides the day-to-day leadership for the NSLS-II Project and consists of the NSLS-II Program Manager, the NSLS-II Federal Project Director, the NSLS-II Deputy Federal Project Director, the BNL NSLS-II Project Director, and the BNL NSLS-II Deputy Project Director.

The NSLS-II Federal Project Director, located at BHSO, will serve as the Team Leader. The NSLS-II Federal Project Director's responsibilities involve:

- Leading the Integrated Project Team, providing broad program guidance, and delegating appropriate decision-making authority to the IPT members:
- Preparing and maintaining the Integrated Project Team Charter and operating guidance with IPT support;
- Keeping the IPT and upper management informed;
- Scheduling and holding regular meetings;
- Initiating the development and implementation of key project documentation (e.g., Project Execution Plan);

- Serving as the single point of contact between Federal and contractor staff for all matters relating to the project and its performance;
- Serving as the Contracting Officer's Representative (COR) for the NSLS II Project as determined by the contracting officer;
- Defining the project cost, schedule, performance, and scope baseline;
- Requesting and allocating budget;
- Responsible for assuring that design, construction, environmental, safety, security, health, and quality efforts performed comply with the contract, public law, regulations, and Executive Orders;
- Reporting of timely, reliable, and accurate performance data;
- Evaluating and verifying reported progress; making projections of progress and identifying trends;
- Approving changes in compliance with the approved change control process documented in the Project Execution Plan; and
- Assigning responsibilities to the Deputy Federal Project Director.

The NSLS-II Deputy Federal Project Director will report to the NSLS-II Federal Project Director and perform assigned duties. The NSLS-II Deputy Federal Project Director will serve as the NSLS-II Federal Project Director in his/her absence and will be the Alternate COR for the NSLS-II Project.

The NSLS-II Program Manger, located in the SC Office of Basic Energy Sciences, plays a key role in providing programmatic guidance to the NSLS-II Federal Project Director and the IPT. The NSLS-II Program Manager's responsibilities involve:

- Overseeing development of project definition, technical scope, and budget to support mission need;
- Developing project performance measures, and monitoring and evaluating project performance throughout the project's life cycle;
- Providing direction to the NSLS-II Project regarding BES budgets;
- Coordinating with BES program elements as needed to facilitate project performance; and
- Overseeing the DOE project line-management organization and ensuring the line project teams have the necessary experience, expertise, and training in design engineering, safety and security analysis, construction, and testing.

The BNL NSLS-II Project Director performs the role of Contractor Project Manager as identified in DOE M 413.3-1 and is the contractor official responsible and accountable for overall successful execution of the contractor's project scope of work, including overall project management and ensuring that the project's objectives in terms of technical parameters, cost, and schedule are achieved in a safe and environmentally compliant manner.

The BNL NSLS-II Project Director's responsibilities involve:

- Supporting the NSLS-II Federal Project Director in implementing DOE project management processes;
- Providing input on project documentation (e.g., Project Execution Plan) and developing and maintaining contractor project documentation;
- Defining and leading the contractor project organization (i.e., the BNL NSLS-II Project Office).
- Implementing a contractor performance measurement system;

- Monitoring the technical design;
- Proactively identifying and ensuring timely resolution of critical issues within the contractor's control which impact project performance;
- Communicating accurate and reliable project status and performance issues to DOE;
- Ensuring that the Project's ES&H and QA goals are achieved;
- Identifying and managing project risks;
- Managing the contractor's management reserve funds; and
- Assigning responsibilities to the BNL NSLS-II Deputy Project Director.

The BNL NSLS-II Deputy Project Director reports to the BNL NSLS-II Project Director and is responsible for day-to-day project management of the NSLS-II Project, ensuring that the project is successfully completed safely, on time, and within budget.

10.3.3 Support Members

The Support Members are involved in the daily activities of the NSLS-II Project and have functions in project management, project controls, field execution, safety oversight, and/or business operations that are integral to the NSLS-II Project. Because of the progressive and dynamic nature of a project, the personnel skill and knowledge mix will change throughout the project's lifecycle. Unexpected events and requirements may arise that require resources beyond that of the core IPT. As such, the type and amount of personnel support will vary and the IPT membership may change to incorporate the necessary skills and expertise. This flexibility allows the Federal Project Director to adapt the team to meet specific needs. The Federal Project Director and Core Members will identify those resource gaps and determine the timing and level of support needed. The Executive Members are responsible for ensuring that needed support is provided from their respective organizations.

For DOE, matrix support will be provided from the BHSO Office of the Manager, the Operations Management Division (OMD), and the Business Management Division (BMD). As such, the OMD and BMD Directors are the key Support Members on the IPT and are responsible for providing matrix support to the Federal Project Director from their respective organizations. Matrix support may also be obtained from the two SC integrated support centers, i.e. the Chicago Office (CH) and the Oak Ridge Office. Contract mechanisms for support service contractor support to fill short term needs are available through CH. Contractor Support Members mainly reside in the BNL NSLS-II Project Office but matrix support will be obtained from other BNL organizations as needed.

The responsibilities of the Support Members of the IPT are contained in Table 10.6.1.

10.3.4 IPT Scope of Effort and Limits of Authority

The IPT is governed by this formal charter, which defines the scope of effort and the limits of authority. Roles and responsibilities of the IPT members are specified in Sections10.3 and 10.6.

10.4. Requirements

The IPT members assisted the NSLS-II Federal Project Director with preparing this Charter. The NSLS-II Federal Project Director, in coordination with the NSLS-II Program Manager, maintains authority for final decision making and communicates to the team the decision making strategy used for specific issues.

The operating guidelines described in Sections 10.4.1 through 10.4.3 address how the team will govern itself.

10.4.1 Communications

Communications Internal to IPT:

- The NSLS-II Federal Project Director will communicate to the team the goals and purpose of the team; each team member's expected level of contribution to meeting goals and expectations; and all issues related to successful team performance.

- The NSLS- II Federal Project Director will ensure that summaries that appropriate meeting documentation is created, maintained, and distributed. This responsibility may be delegated.

- Any IPT member is authorized to communicate with any other IPT member, or support staff, as necessary to accomplish and fulfill his or her roles and responsibilities.

Communications External to IPT:

- Communications external to the IPT are the responsibility of the Core Members.

- The NSLS-II Federal Project Director will ensure that adequate and frequent communication regarding DOE policy and its impacts on site projects is delivered to the contractor in a timely manner.

10.4.2 Meetings

The IPT will participate in the following routine meetings to support the NSLS-II Federal Project Director:

Core Member Weekly Meeting

The Weekly Meeting will be chaired by the NSLS-II Federal Project Director and used to focus on project issues and resolution among the Core Members. Other members may be brought in as needed.

Draft Agenda:

- Key project updates since last week
- Status of last week's action items.

- Identification of new issues requiring resolution and possible strategies.
- Coordination of upcoming information needs by the Core Members

Monthly Performance Review

This meeting will be chaired by the NSLS-II Federal Project Director and will focus on scope, cost and schedule performance to aide the Federal Project Director in his/her project monitoring and reporting duties. The basis for the meeting will be the Contractor Monthly Project Report. The BNL NSLS-II Project Director and his/her staff are responsible for organizing the meeting, keeping appropriate meeting records and presenting performance.

Draft Agenda:

- Presentation of Contractor Scope, Cost and Schedule Performance
- Issues and Corrective Actions
- Risk Management

Other meetings may be scheduled as needed by NSLS-II Federal Project Director and the IPT.

10.5 Records

The following records are generated by this Charter and are retained.

- IPT meeting summaries and/or minutes, including decisions and tracking of action items and issues and presentations.

10.6 Integrated Project Team Roles and Responsibilities

The NSLS-II IPT consists of the expertise and authority to effectively plan and implement the project. Key members of the IPT and their roles and responsibilities are described in Table 10.6.1. There is an appropriate mix of skills among the team members to successfully execute this project. Additional members from other BHSO, BNL and the NSLS-II support organizations will participate as needed.

Table 10.6.1 NSLS-II Project IPT Members and Primary Areas of Responsibility or Support

Executive Members	
Director, BES	Champions NSLS-II Project at SC Headquarters. Ensures that necessary SC Headquarters resources and support are provided to the NSLS-II Project.
Manager, BHSO	Champions NSLS-II Project at BSHO. Ensures that necessary BHSO resources and support are provided to the NSLS-II Federal Project Director.
Director, Brookhaven National Laboratory	Champions NSLS-II Project at BNL. Ensures that necessary BNL resources and support are provided to the BNL NSLS-II Project Director.
Core Members	
NSLS-II Program Manager, SC	Provides programmatic guidance for the NSLS-II Project via the Federal Project Director.
NSLS-II Federal Project Director, BHSO	Has overall responsibility for planning, implementing, and completing the NSLS-II Project. He/She will provide overall project management oversight, issue work authorizations, provide necessary funds via approved financial plans, submit key project documents and critical decisions to DOE, report project progress, and assess NSLS-II Project execution performance.
NSLS-II Deputy Federal Project Director, BHSO	Reports to the Federal Project Director, is the alternate COR and performs duties as assigned by the Federal Project Director. Acts as the Federal Project Director in his/her absence.
NSLS-II Project Director, BNL	The NSLS-II Project Director is the Contractor Project Manager and reports to the BNL Director. He/She is directly responsible for the overall successful execution of the NSLS-II Project, including overall project management and ensuring that the project's objectives in terms of technical parameters, cost, and schedule are achieved in a safe and environmentally compliant manner.
NSLS-II Deputy Project Director, BNL	Reports to the NSLS-II Project Director and is responsible for day-to-day project management of the NSLS-II Project, ensuring that the project is completed safely, on time, and within budget.
Support Members	
Director, OMD, BHSO	The OMD Director provides matrix support to the NSLS-II Federal Project Director in the areas of Environment, Safety, Health and Quality oversight.
Director, BMD, BHSO	The BMD Director is the Contracting Officer responsible for overall administration of the M&O contract with the Brookhaven Science Associates. Also provides matrix support to the NSLS-II Federal Project Director in the areas of finance; subcontracting; and M&O contract management and performance measurement.

Table 10.6.1 NSLS-II Project IPT Members and Primary Areas of Responsibility or Support (cont.)

NSLS-II Project Support Division Director, BNL	Reports to the NSLS-II Project Director and is responsible for the coordination of all project support functions including project controls, business, human resources, procurement, information technology, facilities, and document management.
NSLS-II Procurement Manager, BNL	Reports to the BNL Director of Procurement and Property Management and is assigned to the NSLS-II Project Support Division Director. Manages acquisition of goods and services in full compliance with all federal, state, and local regulations and in the most cost effective manner.
NSLS-II Environmental, Safety and Health Manager, BNL	Reports to the NSLS-II Project Director and is responsible for developing and implementing the ES&H program to ensure NSLS-II is designed and constructed and operated in accordance with applicable BNL and DOE requirements to protect workers and the environment.
NSLS-II Quality Assurance Manager, BNL	Reports to the NSLS-II Project Director and is responsible for developing and implementing QA program to ensure NSLS-II is designed and constructed in accordance with applicable BNL and DOE Quality Assurance requirements.
NSLS-II Accelerator Systems Division Director, BNL	Reports to the NSLS-II Project Director and is responsible for oversight and management of scientific, engineering, and technical staff and for directing the design, fabrication, installation, testing, and commissioning of accelerator and control systems. Also responsible for executing their respective portion of the project safely and within approved budget and schedule.
NSLS-II Experimental Facilities Division Director, BNL	Reports to the NSLS-II Project Director and is responsible for the oversight and management of scientific, engineering, and technical staff and for all aspects of experimental facilities, including beamline and instruments systems. Also responsible for executing their respective portion of the project safely and within approved budget and schedule.
NSLS-II Conventional Facilities Division Director, BNL	Reports to the NSLS-II Project Director and is responsible for directing the design and construction of the facilities required for housing and serving the technical systems and research equipment. Also responsible for executing their respective portion of the project safely and within approved budget and schedule.

NATIONAL SYNCHROTRON LIGHT SOURCE II PROJECT EXECUTION PLAN

APPENDIX A - OFFICE OF SCIENCE PROGRAM PLANS AND CONTROLLED ITEMS

William Brinkman Date
Director for Office of Science

The contents of this PEP section are under the purview and control of the Director, Office of Science, DOE, who must approve and sign all changes.

CHANGE SYNOPSIS FOR APPENDIX A

Revision	Effective Date	Summary of Change
0	October 17, 2007	Updated Preliminary Project Execution Plan to Project Execution Plan in support of the Critical Decision 2 (CD-2) review and approval process.
1	November 16, 2007	Changes made in response to External Independent Review and Independent Project Review performed in support of CD-2 approval. Clarification regarding scope completion added to Section A.7. Clarified beneficial occupancy milestone in Table A-4.5. Level 1B cost change control elements added. Miscellaneous changes made to provide consistency made to the PEP base document.
2	November 14, 2008	Updates for CD-3: 1. Changed signature page to reflect that this appendix is approved by the PSO 2. Update discussion of acquisition strategy. 3. Updated Table A-4.5 Milestones 4. Updated Table A8.1 BAC
3	September 30, 2009	Various updates listed below: 1. Updated signature page to reflect personnel changes. 2. Updated major milestone schedule and BAC table.

NATIONAL SYNCHROTRON LIGHT SOURCE II PROJECT EXECUTION PLAN APPENDIX A

A1. INTRODUCTION

This appendix of the NSLS-II Project PEP supplements the base document by providing additional detail on management and execution of the NSLS-II Project. This section does not repeat information included in the other appendices or information contained in other project documents. Changes to this appendix are at the sole discretion of the Director, Office of Science, who serves as the Program Secretarial Officer (PSO), although all revisions are provided to the Under Secretary for Science, the Secretarial Acquisition Executive (SAE) and to the NSLS-II Federal Project Director.

A2. MISSION NEED AND JUSTIFICATION

See Section 2, Mission Need and Justification, of the PEP base document.

A3. PROJECT DESCRIPTION

See Section 3, Project Description, of the PEP base document.

A4. MANAGEMENT SYSTEMS

A4.1 Organization and Responsibilities

The NSLS-II Program Manager relies on and uses Office of Science and other Departmental staff organizations for support in execution of the NSLS-II Project. A summary DOE organizational diagram for the NSLS-II Project is given in Figure A-4.1.

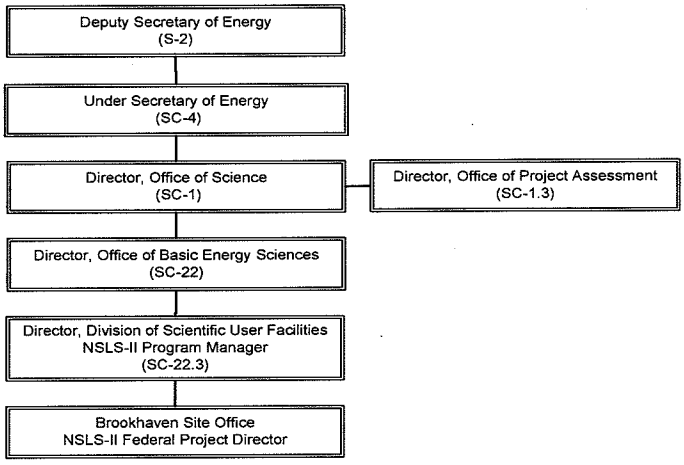

Figure A-4.1 DOE NSLS-II Summary Organization

A4.2 Work Breakdown Structure

A project work breakdown structure (WBS) and dictionary has been defined in Section 4.2 and Appendix D and will be controlled by the thresholds defined in Section 8 of the PEP base document.

A4.3 Acquisition Strategy

The Acquisition Strategy is defined in Section 4.3 of the PEP base document. DOE is acquiring design, construction, and operation of NSLS-II through the M&O contractor responsible for BNL, currently Brookhaven Science Associates. The preparation of the conceptual design and preliminary baseline range resulted in the identification of potential long lead procurement items that, if pursued, would reduce project costs and mitigate schedule risk for the entire project. As described in Section 9 of the PEP base document, approval of Long Lead Procurements with values less than $25 million is delegated to the PSO. Since CD-2 approval in January 2008, there have been no changes to the project baseline that would necessitate a re-evaluation or update of the Acquisition Strategy.

A4.4 Work Authorization

Work authorization documents will be issued to the field to initiate, continue, or redirect project effort and to identify funds being allocated via an approved financial plan. These documents will be issued as needed, but no less than annually, in accordance with Office of Science procedures.

A4.5 Project Summary Schedule

The list of Level 1B milestones, completion criteria and late finish dates (to meet CD-4) to construct NSLS-II follows. Level 1B milestones are under the control of the Director, Office of Basic Energy Sciences (BES), who controls the early finish date.

Table A-4.5 Office of Science (Level 1B) Controlled Milestones and Completion Criteria

Code	Title	Completion Criteria	Date
L100010	CD-0, Approve Mission Need	See Section 4.4 of the PEP base document for milestone definition. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-0.	8/25/05 (actual)
L100020	CD-1, Approve Alternative Selection and Cost Range	See Section 4.4 of the PEP base document for milestone definition. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-1.	7/12/07 (actual)
L100030	CD-2, Approve Performance Baseline	See Section 4.4 of the PEP base document for milestone definition. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-2.	1/18/08 (actual)
L100040	CD-3, Approve Start of Construction	See Section 4.4 of the PEP base document for milestone definition. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the PSO approving CD-3.	1/9/09 (actual)

L100060	BOD of Experimental Floor Space	Completion of this milestone is defined as the date on which beneficial occupancy of a portion of the Ring Building is transferred from the Conventional Facilities Division to the Accelerator Systems Division after all reviews and approvals required by the Readiness Evaluations Subject Area have been completed. This milestone authorizes beneficial occupancy of a portion of the experimental floor for the purposes of installing and commissioning beamlines and equipment, including those not associated with the NSLS-II Project.	8/6/12
L100900	NSLS-II DOE Early Project Completion	This milestone is the early completion for CD-4 including three additional months of float. See Section 4.4 of the PEP base document for the milestone definition for CD-4. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-4.	9/30/14
L100100	CD-4, Approve Project Completion*	See Section 4.4 of the PEP base document for milestone definition. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-4.	6/26/15

* Any increase of the project completion date (i.e. CD-4) is a deviation and approvals are performed in accordance with Table 8.1 of the PEP base document.

A4.6 Financial Management

See Section 4.6 of the PEP base document.

A4.7 Quality Assurance

SC activities are conducted in accordance with the *Office of Science Quality Assurance Programs*. Approval of the Brookhaven Site Office Quality Assurance Program is delegated to the Brookhaven Site Office Manager.

A4.8 Project Monitoring, Assessment and Reviews

Monitoring and assessment of the NSLS-II Project will occur through routine interfaces among project participants (e.g., periodic informal conference calls among the contractor management, DOE BHSO project office, and DOE SC staff), Integrated Project Team meetings, periodic formal project status reports, and project reviews organized by the SC Office of Project Assessment (SC-28). Such reviews will be typically conducted on a semiannual basis; however, ad hoc reviews on special topics (e.g., Environment, Safety, and Health) may be held as deemed necessary by SC. Monthly project status reports will be submitted to the NSLS-II Program Manager by the NSLS-II Federal Project Director which will include an overview and his/her assessment of the project status.

Independent Project Reviews are performed by the SC Office of Project Assessment (SC-28) to support approval of CD-2 and CD-3. These are performed jointly with the OECM External Independent Project Reviews; the division of responsibility is described in Section 9 NSLS-II Project Tailoring Strategy of the PEP base document.

A5. ENVIRONMENT, SAFETY, HEALTH, AND SECURITY

Siting – The NEPA process was used to evaluate the environmental consequences of locating the NSLS-II facility at the preferred site at Brookhaven National Laboratory (BNL). An Environmental Assessment was completed and a Finding of No Significant Impact was approved by the BHSO Manager.

Basic Energy Sciences Policy – The Office of Basic Energy Sciences (BES) is committed to conducting work (research and projects) in a manner that ensures protection of the workers, the public, and the environment. Protecting the workers, the public, and the environment is a direct and individual responsibility of all BES managers and BES-supported workers and their staff. Funds provided by BES will be applied as necessary to ensure that all BES work is conducted safely and in an environmentally conscientious manner. Only work conducted in this way will be supported.

The NSLS-II Project is committed to this stated BES policy for conducting work in a safe and environmentally conscientious manner.

Operational Safety Basis – Approval of safety documents and authorization to commission and operate NSLS-II will occur prior to commissioning and operation of NSLS-II facility systems, including the injector, storage ring, and photon beam stops. The NSLS-II Federal Project Director is responsible for establishing the safety basis and operations in accordance with DOE Order 420.2B, *Safety of Accelerator Facilities*. Approval will be granted by the Brookhaven Site Office Manager.

High Performance Sustainable Building Considerations - The NSLS-II Project incorporates high performance sustainable building considerations in accordance with the guiding principles of Executive Order 13423 as described in Section 5.5 of the PEP base document.

A6. RESOURCE PLANNING

See Section 6 of the PEP base document.

A7. TRANSITION TO OPERATIONS

NSLS-II will complete the transition to operations in two main steps: 1) beneficial occupancy of a portion of the experimental floor to support beamline installation and integrated testing; and, 2) final commissioning and operation of the complete facility in support of the operating phase that follows completion of the construction project.

Once the storage ring is ready to store an electron beam, a series of commissioning activities will be undertaken to demonstrate that all components of the injection system and the storage ring are working properly and in concert for storing beam at a satisfactory level. For project completion (CD-4), NSLS-II must have in place all capital facilities defined in the WBS Dictionary, the current version (to Level 3) of which is contained in Appendix D and is under change control as defined in Section 8 of the PEP base document, and have conducted initial performance tests to demonstrate operation to meet the NSLS-II Threshold Key Performance Parameters at Project Completion contained in Table 4.4.1 in the PEP base

document. The phased start of NSLS-II facility operations is essential to enable a smooth transition of the 2,500 users at the existing NSLS to NSLS-II.

The DOE Program/Project team will conduct a Project Completion Review to meet the objective of the "operational readiness review" described in DOE Order 413.3A *Program and Project Management for the Acquisition of Capital Assets* (not to be confused with the Operational Readiness Review specified in DOE Order 420.2B, *Safety of Accelerator Facilities*). This review and completion of the performance tests will be documented in a Project Completion Report, which will serve as the basis for a request to the SAE for approval of CD-4. Approval of CD-4 completes the construction phase of the project, and the NSLS-II will enter the normal research operations phase.

A8. PERFORMANCE BASELINE AND CHANGE CONTROL

Change control thresholds are defined in Section 8 of the PEP base document. Level 1B milestones and completion criteria are contained in Section A4.5. The Level 1B cost elements under change control, i.e. the BAC for the Level 2 WBS elements, are listed in Table A8.1.

All Deviations and Level 1 changes will be submitted to the Office of Science Change Control Board Secretariat. The Office of Project Assessment is responsible for administering the SC change control process.

Table A8.1 NSLS-II Project WBS Level 2 Element Budget at Complete (BAC)

WBS #	Title	BAC
1.01	Project Management	$54,268,017
1.02	R&D and Conceptual Design	$60,612,767
1.03	Accelerator Systems	$252,177,664
1.04	Experimental Systems	$70,283,960
1.05	Conventional Facilities	$254,440,008
1.06	Pre-Operations	$50,200,405

NATIONAL SYNCHROTRON LIGHT SOURCE II
PROJECT EXECUTION PLAN

APPENDIX B - DOE-BHSO PROJECT OFFICE PLANS AND CONTROLLED ITEMS

Frank Crescenzo — Date
NSLS-II Federal Project Director

The contents of this PEP section are under the purview and control of the DOE-BHSO NSLS-II Federal Project Director, who must approve and sign all changes.

CHANGE SYNOPSIS FOR APPENDIX B

Revision	Effective Date	Summary of Change
0	October 17, 2007	Updated Preliminary Project Execution Plan to Project Execution Plan in support of the Critical Decision 2 (CD-2) review and approval process.
1	November 7, 2007	Maximum number of matrix support staff provided to BHSO NSLS-II Project Office corrected from 7 to 5.
2	November 16, 2007	Changes made to federal project functions, federal risk management, and level 2 milestones in response to the Independent Project Review and External Independent Review (EIR) performed in support of CD-2 approval. Level 2 cost change control elements added.
3	November 14, 2008	Updates for CD-3: 1. Revised FPD 2. Added completions dates to FPD controlled milestones. 3. Updated subcontract approval authority to reflect increase in HQ delegation to $50m 4. Update BAC
4	September 30, 2009	Updates for 1. Dates for completed controlled milestones 2. Variance report issue dates 3. Variance analysis requirements 4. Level 3 BAC table

NATIONAL SYNCHROTRON LIGHT SOURCE II PROJECT EXECUTION PLAN APPENDIX B

B1. INTRODUCTION

This Appendix B of the NSLS-II PEP supplements the base document and Appendix A by providing additional detail on management and execution of the NSLS-II Project by the Brookhaven Site Office and the Federal Project Director. This section does not repeat information included in the other appendices or information contained in other project documents. Level 2 baseline elements (technical, schedule, and cost) controlled by the Federal Project Director are identified, along with the thresholds for application of formal change control processes. Changes to this appendix are at the sole discretion of the Federal Project Director, although all revisions are provided to the NSLS-II Program Manager.

The PEP is the primary reference document for all project management and control processes. Technical requirements, policies, procedures, procurements, budgeting and finance, work authorization, management, reporting, reviews and evaluations, etc., flow down from the PEP.

B2. MISSION NEED AND JUSTIFICATION

See Section 2, Mission Need and Justification, of the PEP base document.

B3. PROJECT DESCRIPTION

See Section 3, Project Description, of the PEP base document.

B4. MANAGEMENT SYSTEMS

B4.1 Organization and Responsibilities

The Federal Project Director leads a project office with a dedicated full-time staff to oversee and direct project activities, relying on part-time BHSO matrix staff for supplemental support. The DOE BHSO NSLS-II Project Office will have a peak staff of approximately three directly assigned individuals. This office will be supplemented by part-time matrix support estimated at a maximum of approximately five full-time equivalents (FTEs). Federal staffing requirements for the NSLS-II Project have been incorporated into BHSO's staffing plans.

The Federal Project Director reports to the BHSO manager, is a member of the BHSO senior staff and attends weekly BHSO senior staff meetings. This is the primary vehicle for communicating and resolving BHSO support needs. The BHSO manager is an Executive Member of the NSLS-II Integrated Project Team (see Section 10 of the PEP base document), with responsibility for ensuring that the necessary BHSO resources and support are provided and that needed approvals are performed in a timely manner.

The matrix personnel resources are provided primarily through staff assignments from various BHSO organizations. The matrix capabilities within the BHSO include contracting officer authorities, procurement and business, budgeting and finance, project management and controls, environmental, safety, and community outreach. The Project Office also receives management support from the BHSO Manager and Deputy Manager. These matrix support capabilities are considered adequate for most all phases of the project through CD-4. Budget is available to the Project Office to purchase support service contractors as needed to augment existing staff or provide specialized technical services.

There may be occasions where overlapping activities may exceed the capabilities of the Project Office and BHSO. Matrix support is also available from the Chicago Office (CH), which serves as an SC Integrated Support Center. The Chicago Office provides a wide array of support services including some that are not readily available in BHSO such as fire protection, security and human resources. Legal support is also provided by the Chicago Office and there are two attorneys stationed at BHSO. Requests for technical services (e.g. technical assessments or reviews) for the upcoming year are coordinated each September by the BHSO Operations Management Division Director with the CH Assistant Manager of Safety, Technical and Infrastructure Services. Requests for support can also be negotiated on an as-needed basis should new needs arise.

A summary BHSO organizational diagram for the NSLS-II Project is given in Figure B-1. The Federal Project Director is responsible for overseeing the prime contractor's effort to design, procure, and construct the NSLS-II facility within the approved baseline. Collectively, the project office expects to utilize seven FTEs including those permanently assigned to the project and part time from matrix organizations. This does not include management support and oversight services that will be provided from DOE SC Headquarters. These services are estimated at 2 to 3 FTEs.

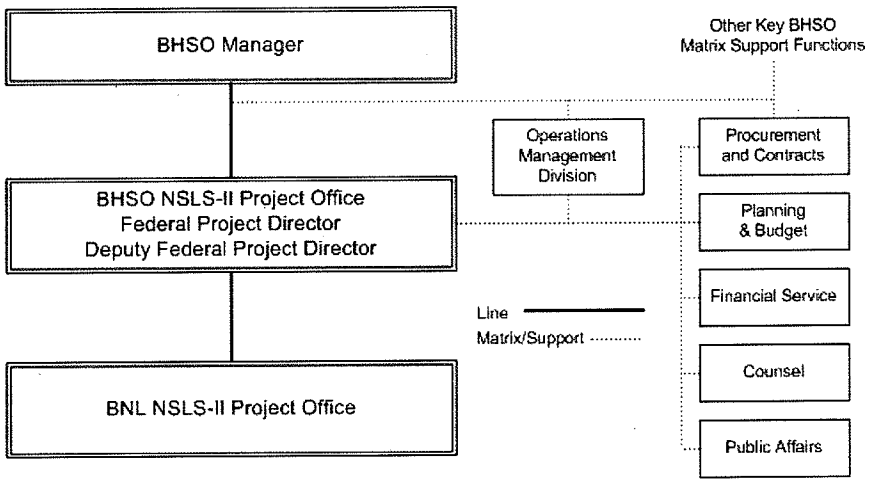

Figure B-1 DOE BHSO Organization for the NSLS-II Project

B4.2 Work Breakdown Structure

The NSLS-II Project work breakdown structure (WBS) has been defined (see Section 4.2 of the PEP base document), and will be controlled by the thresholds defined in Section 8 of the PEP base document.

B4.3 Acquisition Strategy

B4.3.1 Prime Contract

DOE is acquiring design, construction, and operation of NSLS-II through the M&O contractor responsible for BNL, currently Brookhaven Science Associates. This contract is administered by BHSO with authority for NSLS-II Project activities delegated to the Federal Project Director as the Contracting Officer's Representative. Appropriate performance measures are maintained in the M&O contract to promote effective management and completion of the NSLS-II Project.

B4.3.2 Subcontract(s)

To the extent possible, the NSLS-II Project applies performance-based and/or fixed-priced contracting concepts for executing the project. Standard practice is for the NSLS-II Project and its subcontractors to have budget authority to cover, at a minimum, the first increment of work (e.g., first year, first deliverable, contract base period, etc.) to be performed under the subcontract before initiating the procurement process.

Regarding approval of subcontracts, BHSO is delegated approval of subcontracts with a value of less than $10 million. BHSO has delegated approval of subcontracts with a value of less than $5 million to BSA and may consider additional delegations in the future. Subcontracts with a value greater than $10 million but less than $50 million are approved by the Chicago Office. Subcontracts with a value greater than $50 million are approved by Headquarters (HQ). HQ review may be waived by submitting the planned action in September of the previous fiscal year.

B4.3.3 Small and Disadvantaged Businesses

Efforts are made to encourage participation of Small and Disadvantaged Businesses (SDBs) in execution of the NSLS-II Project. The scale and technical complexity of NSLS-II effectively preclude SDBs from principal roles; therefore, the focus is on identifying smaller packages of work that match the capabilities of these firms and soliciting their involvement. Where feasible, targets/goals for SDB participation are included in management agreements and subcontracts with the major project participants.

B4.4 Work Authorization

The Federal Project Director, with Contracting Office concurrence, issues project directives to the NSLS-II Project Director authorizing work. These directives define the specific work authorized for execution by the contractor and specify the project funds available for project activities. Revised directives are issued when new work phases or activities are to begin, and when incremental funds are authorized.

B4.5 Project Summary Schedule

The list of Level 2 milestones, completion criteria and late finish dates (to meet the CD-4 milestone) follows. Level 2 milestones are under the control of the NSLS-II Federal Project Director, who controls to the early finish date for the milestone.

Table B4.1 NSLS-II Federal Project Director Controlled Milestones and Completion Criteria

Code	Title	Completion Criteria	Date
1.01 Project Management			
L200200	Submit PSAD to DOE for Approval	Defined as the completion of the Preliminary Safety Assessment Document (PSAD) and submission to DOE for approval. Milestone complete will be achieved upon the issuance of this document, via transmittal record, from the NSLS-II Project Director to the NSLS-II Federal Project Director.	7/2/08 (actual)
L200320	Issue Initial FSAD for Approval	Defined as the completion of the Final Safety Assessment Document (FSAD) and submission to DOE for approval. Milestone complete will be achieved upon the issuance of this document, via transmittal record, from the NSLS-II Project Director to the NSLS-II Federal Project Director.	3/3/14
L200600	NSLS-II Project Early Completion	This milestone is the early completion for CD-4. See Section 4.4 of the PEP base document for the milestone definition for CD-4. Completion of this milestone is defined as issuance of a signed Decision Memorandum from the SAE approving CD-4.	6/25/14
1.03 Accelerator Systems			
L200260	Contract Award for Booster System	Defined as the date of the BSA award of the subcontract to build the Booster. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	3/4/10
L200380	Front-End Beam Available to Linac	Defined as the completion of initial front-end commissioning activities and the front-end diagnostic equipment and beam stop being removed. The remaining front-end commissioning activities will occur concurrently with Linac commissioning. The completion of this milestone will be granted upon receipt by the NSLS-II Federal Project Director of a memorandum, with supporting technical documentation, from the NSLS-II Project Director stating that initial commissioning requirements have been achieved and that the beam is now available to the Linac.	12/17/12
L200400	Linac Beam Available to Booster	Defined as the completion of initial Linac commissioning activities and the completion of Linac-to-Booster transport section commissioning. The remaining Linac commissioning activities will occur concurrently with ring commissioning. The completion of this milestone will be granted upon the receipt by the NSLS-II Federal Project Director of a memorandum, with supporting technical documentation, from the NSLS-II Project Director stating that initial commissioning requirements have been achieved and that the beam is now available to the Booster.	2/22/13
L200440	Ring Beam Available to Beamlines	Defined as the completion of initial ring commissioning activities and the completion of the beam dump commissioning. The remaining ring commissioning activities will occur concurrently with beamline commissioning. The completion of this milestone will be granted upon the receipt by the NSLS-II Federal Project Director of a memorandum, with supporting technical documentation, from the NSLS-II Project Director stating that initial commissioning requirements have been achieved and that the beam is now available to the beamlines.	6/25/14

1.04 Experimental Facilities			
L200350	Experimental Facilities Beamlines Design Complete	Defined as the completion of all beamline Final Design Reviews that are required before beamline installation can proceed. Completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	2/7/12
1.05 Conventional Facilities			
L200220	Begin Site Prep	Defined as the beginning of site work to include initial tree harvesting and access road construction. Completion of the milestone will be granted upon the receipt of a memorandum to the NSLS-II Federal Project Director from the NSLS-II Project Director that this condition exists.	11/10/08 (actual)
L200100	100% Conventional Facility Design Complete	Defined as submittal of the final design for conventional facilities. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	8/25/08 (actual)
L200240	Issue Ring Building NTP	Defined as the date on which BSA issues the Notice to Proceed (NTP) for the Ring Building to the Conventional Facilities subcontractor. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	3/25/09 (actual)
L200340	Injection Building BOD	Defined as the date on which beneficial occupancy of the Injection building is transferred from the Conventional Facilities Division to the Accelerator Systems Division after all reviews and approvals required by the Readiness Evaluations Subject Area have been completed. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	11/28/11
L200300	RF Building BOD	Defined as the date on which beneficial occupancy of the RF building is transferred from the Conventional Facilities Division to the Accelerator Systems Division after all reviews and approvals required by the Readiness Evaluations Subject Area have been completed. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	5/18/11
L200280	Ring Building Pentant #1 BOD	Defined as the date on which beneficial occupancy of the first pentant of the Ring Building is transferred from the Conventional Facilities Division to the Accelerator Systems Division after all reviews and approvals required by the Readiness Evaluations Subject Area have been completed. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	2/1/11

L200360	Ring Building Pentant #4 BOD	Defined as the date on which beneficial occupancy of the forth pentant of the Ring Building is transferred from the Conventional Facilities Division to the Accelerator Systems Division after all reviews and approvals required by the Readiness Evaluations Subject Area have been completed. The completion of this milestone will be granted upon the receipt of a memorandum from the NSLS-II Project Director to the NSLS-II Federal Project Director that this condition exists.	2/9/12
L2004200	Conventional Facilities Construction Complete	Defined as all conventional facility construction complete. After this point, any facility issues will be handled by maintenance. Completion of this milestone will be granted upon the receipt of a memorandum to the NSLS-II Federal Project Director from the NSLS-II Project Director that the facility has passed walk through inspection.	8/20/13

B4.6 Financial Management

B4.6.1 Definitions

Total Estimated Cost (TEC)

Budgets for the NSLS-II Project delineate the project total estimated cost (TEC) as the anticipated capital costs directly associated with design and construction of the facility. The TEC includes design, construction, equipment and its installation and associated management, contingency, and escalation. These costs typically require project-specific congressional authorization.

Other Project Costs

Budgets for the NSLS-II Project delineate other project costs (OPC) associated with expenditures (expense and capital equipment) required to support the capital effort (design and construction) to the point of turning the facility over for routine operation. OPC includes conceptual design, research and development required to support the design, NEPA documentation, preoperational costs, facility commissioning, and associated management and escalation. These costs do not typically require project-specific congressional authorization, but they have a direct relationship to the capital costs for which congressional authorization is required.

Total Project Cost (TPC)

TPC = TEC + OPC

B4.6.2 Budget Allocation

Appropriated funds are distributed to the NSLS-II Project through contract modifications based on the approved financial plans. Scope is authorized by work authorizations and project directives.

B4.6.3 Cost Collection

Actual cost (invoices, cost transfers, and accrued costs) for work performed on the NSLS-II Project are accumulated by BSA using appropriate accounting procedures and systems.

B4.6.4 Performance Measurement

Actual cost of work performed (ACWP), using accrued costs, and progress (earned value or budgeted cost of work performed (BCWP)) on the NSLS-II Project will be collected using a project-wide reporting and controls system, with routine monthly reporting to DOE at WBS level 3. Project performance data will be tracked against the baseline, variance analyses performed, needed corrective actions identified, and future risks identified. DOE project reporting requirements are detailed in Section B4.8 Project Reporting, Assessment and Reviews. Project Change Requests (PCRs) and Baseline Change Proposals (BCPs) will be prepared and submitted to change control boards commensurate with predetermined thresholds. Variance thresholds establish the limits beyond which formal explanations are required internally and in official reports to DOE. The project control system will be operational to support CD-2 and thereafter throughout the life of the project.

The BSA contract requires that the BNL EVMS system be compliant with ANSI Standard ASNI/EIA-748-A-1998. OECM performed a validation review in October 2007.

B4.6.5 Periodic Estimate at Completion (EAC)

One of the most important indicators of the financial health of a project is management's realistic estimate of the cost to complete the job. When added to the cost already incurred, the result is the estimate at completion (EAC). Because of the dynamic nature of projects such as the NSLS-II, the formal performance measurement baseline will always lag behind this estimate of "management's best judgment." Throughout the project execution phase, as the information base grows (actual cost history, design maturity, procurement experience, etc.), periodic, comprehensive, detailed "bottom up" estimates of the cost to complete the project will be developed. These will be prepared annually, or when conditions indicate that a substantive impact on the project is developing. In addition, adjustments to the EAC should be made on a continuing basis to reflect new information and keep the management assessment current. The methodology to track and report this information is integral to earned value performance measurement systems.

B4.6.6 Contingency and Management Reserve

Contingency will be budgeted to cover costs that may result from incomplete design and uncertainties associated with market conditions, technical difficulties, schedule delays, and other circumstances commonly encountered during project execution. It may also be used to implement design changes that optimize the scientific capability or enhance the possibility of future upgrades of NSLS-II.

In developing the project's performance baseline cost estimate, contingency estimates will be developed for each major cost element, usually at WBS element level 4 or lower, using a risk-based contingency approach. This approach is described in the NSLS-II Risk Management Plan. Each contribution to the total contingency is based on an assessment of the technical, cost, and schedule risk combined with a weighting factor that reflects the type of cost (labor or material). This yields the contingency percentage for this element of the project. The contingency contribution is determined by multiplying the base cost by the calculated contingency percentage. The NSLS-II Federal Project Director, with the concurrence of the Director, Office of Basic Energy Sciences, may assign a portion of the contingency to the NSLS-II Project Director for use as management reserve. Management reserve may also be generated via cost savings from approved Level 3 baseline change proposals. The use of Management Reserve is approved by the NSLS-II Project Director via the baseline change control process.

The amount of contingency that is needed at any given time will depend on the status of design, procurement, and construction and the complexity and uncertainty of the component parts of the project. Contingency is not included in the TEC for external factors that cannot be reasonably foreseen or quantified, such as major regulatory changes, annual funding shortfalls (appropriation less than baseline funding level), or ramifications from acts of international terrorism. When such circumstances occur, they are treated as "directed changes," requiring work-around plans and/or additional schedule and budget allowances.

The distribution of the project contingency and management reserve, if established, is controlled in accordance with the baseline change control process. Formal baseline changes will normally be made following a project-wide estimate at completion process or on individual elements when the existing baseline no longer provides a reasonable basis for performance measurement.

The contingency budget will be managed at the overall NSLS-II Project level. This will allow contingency (if required) to be more flexibly applied, i.e., to optimize its use for the portion of the project that has problems and requires rebaselining and not reserve contingency allocation solely on an individual WBS element basis.

Once the performance baseline is approved at CD-2, work is being performed, costs accrued, and problems encountered and solved, an EAC for completing its baseline scope will be developed to reflect management's best judgment of the forecast final cost of each WBS element. The EAC should be updated on a comprehensive basis at least once a year and for individual WBS elements whenever information becomes available that will impact the final cost of that element. By comparing to the TPC, a contingency based on EAC can be calculated at any point in time. This estimate of contingency is therefore controlled by the NSLS-II Project Director.

During project execution, the available contingency is the remainder when the estimate for doing a job is subtracted from the total amount budgeted. Since the "estimate" might be either the formal performance measurement baseline or the current, most realistic estimate, NSLS-II Project contingency can be stated in either of two ways: 1) the difference between the approved TEC and the BAC or 2) the difference between the TEC and the EAC. Either value might be appropriate for discussion, depending on the context.

Management of cost, schedule, and technical risks is integral to contingency management. NSLS-II Project management evaluates project risk issues on a continuing basis during project execution. DOE will review this subject on at least a semiannual basis as part of the Office of Science reviews.

B4.6.7 Annual Operating Cost

Updated annual operating cost estimates will be generated during the project as appropriate.

B4.6.8 Decontamination and Decommissioning Cost Estimate

An approximation of decontamination and decommissioning (D&D) cost for the NSLS-II at the end of its useful life are estimated at $30M based on estimated costs for similar facilities. This is anticipated to include the removal of reusable/valuable equipment and materials, any activated materials, contaminated process fluids and waste materials, and the D&D of remaining building structures.

B4.6.9 Life Cycle Cost

The project life-cycle cost reflecting the TPC for design and construction, operation for the 30-year design life, and eventual decommissioning is estimated to be $4.3 billion in FY07 dollars. This reflects the sum of the TPC for design and construction of approximately $800 million (in FY07 dollars), annual operating costs of approximately $115 million (in FY07 dollars) over the 30-year design life of the facility, and eventual decommissioning costs of $30 million.

B4.7 Quality Assurance

BHSO quality assurance activities are performed in accordance with the BHSO Quality Management Plan, July 18, 2007, and subsequent updates, which has been approved by the BHSO Manager.

BSA has a DOE-approved quality assurance program. An NSLS-II Quality Assurance Plan has been prepared in accordance with the approved BSA QA program.

B4.8 Project Monitoring, Assessment and Reviews

Real-time monitoring of the NSLS-II Project will occur through routine interface among project participants; however, periodic formal meetings and reviews will be conducted to document project status and action items. The Federal Project Director will maintain awareness of project activities and status through the following:

Quarterly Progress Reviews: The Federal Project Director will review project status with the Under Secretary for Science as described in Section 4.8 of the PEP base document.

Monthly Project Status Meeting: The Federal Project Director reviews progress with the NSLS-II Project Director since the previous meeting regarding configuration control activity and project issues.

Configuration Control: As defined in Section 8 of the PEP base document and Section B8 of this appendix, the Federal Project Director reviews proposed baseline changes and provides approval or rejection for Level 2 proposed changes and concurrence or rejection for Level 0 and 1 proposed changes.

The NSLS-II Project team will issue the following project reports:

1. **Project Status Report:** The NSLS-II Project Director will submit project status reports to the NSLS-II Federal Project Director by the 20th of each month that contain the following:

    - The NSLS-II Project Director's overview and assessment of the project
    - A narrative describing the status of technical work, significant project accomplishments, and problems. Pictures will be included when appropriate.
    - A milestone schedule and status log for Level 1 through 3 controlled milestones will be included in this report.
    - Cost performance reports at WBS level 3 in the following formats (or equivalent).
        - Format 1 – WBS
        - Format 2 – Organizational Categories
        - Format 3 – Baseline

- Progress performance charts, including Cost Performance Index (CPI) and Schedule Performance Index (SPI) and earned value data, at Level 2 WBS.
- Description of proposed corrective actions for any red or yellow variances at level 2:
  - Green: SPI or CPI of 0.9 – 1.15
  - Yellow: SPI or CPI of 0.85-0.89 or 1.16-1.25
  - Red: SPI or CPI of < 0.85 or > 1.25
- Critical path analysis report.

The report will be issued by the 20th of the month following the reporting month (e.g., a March activity report will be available by April 20th).

Cost and schedule variance reports at WBS Level 2 for a monthly variance of $200K and a cumulative variance of $1M or +/– 10 percent will be submitted by the 20th of the second month following the reporting period (e.g., a March variance analysis report will be due by May 20). The analysis will be discussed at level 3.

Changes to these monthly reporting requirements may be made at the direction of the Federal Project Director.

2. **NSLS-II Federal Project Director's Monthly Report to Headquarters:** The NSLS-II Federal Project Director will submit a Monthly Report to the NSLS-II Program Manager including an overview and his/her assessment of the project status.

3. **Monthly PARS Reports:** The Federal Project Director will submit monthly performance data into PARS.

4. **Project Technical Reports:** Project technical reports will be issued to document special topical items.

5. **Project Procurement Status Reports:** The project procurement status report will be updated and maintained in the project's web-based information system. The information will provide the status of major subcontracts and material procurements.

6. **Annual OMB A-11 Report:** Annually submit a report consistent with the format of OMB A-11, Part 300B.

B4.9 Value Management

Value Management (VM) and Value Engineering (VE) will be performed on the NSLS-II Project to ensure that all essential functions required by the project scope are achieved at the lowest life-cycle cost consistent with safety, performance, reliability, and quality requirements. These VM/VE activities will be performed throughout the life of the NSLS-II Project. VE principles are applied during periodic design review meetings where functional requirements are identified and alternative approaches to achieve these requirements are considered and evaluated. Design review meetings include individuals not directly associated with the NSLS-II Project, project staff, and other project stakeholders. Formal VE reviews are also conducted on the conventional facilities design. VM/VE implementation is the responsibility of the NSLS-II Project Director.

B4.10 Public Participation

Throughout the life of the project, contacts are made with DOE and BNL by public bodies (news media, professional societies, interest groups, local government committees, etc.) seeking information about the project. The project team will be responsive to the needs and desires of these organizations by arranging on-site meetings, visiting their forum, or other appropriate means.

In addition, two standing committees at BNL are central to promoting and sustaining public interaction. The Brookhaven Executive Round Table (BER) was formed in 1997 to provide a forum for frequent, routine, and executive-level communications about BNL. Administered by BHSO, the BER represents the interests of the major stakeholders associated with BNL, including the owner, operator, jurisdictional, regulatory, oversight, community, and political interests. The BER originally met on a monthly basis and now meets as needed, approximately three to four times a year. The other committee, the BNL Community Advisory Council, is administered by BSA and is described further in Section C4.10 in Appendix C.

B4.11 Federal Risk Management

Federal and programmatic risks have been identified by federal project staff with input from the NSLS-II Project Director. These risks, which are generally outside the control of the contractor, include items such as delays in funding due to continuing resolution and delays in DOE approvals. Federal risks are categorized and ranked as outlined in the *NSLS-II Risk Management Plan* and a federal risk registry has been developed that includes the potential problem, likely causes, mitigation plans, and risk owner. Those risks that result in the identification of contingency are also included in the contractor risk registry generated and maintained via the *NSLS-II Project Risk Management Plan.*

Maintenance of the federal risk registry is the responsibility of the Federal Project Director. Status of risk mitigation activities and identification of new risks will be discussed at the weekly federal NSLS-II staff meetings and at IPT meetings. The registry will be updated as needed.

The Federal Project Director and Deputy Federal Project Director are also members of the contractor NSLS-II Risk Management Team and will attend Team meetings.

B5. ENVIRONMENT, SAFETY, AND HEALTH

B5.1 NEPA Compliance

An EA addressing the impacts for constructing and operating NSLS-II at the preferred location in Upton, New York was prepared and describes plans to reduce or eliminate any potential adverse impacts on the Upton area. A Finding of No Significant Impact was also issued.

B5.2 Integrated Safety Management

The project will be planned and executed in accordance with applicable DOE orders and BHSO and BNL's Integrated Safety Management System (ISMS), which recognize the commitment to protect the environment and the safety of workers and the general public. This will be accomplished through:

1. defining the facilities, systems, and components needed to meet mission requirements;
2. analyzing the potential hazards;
3. designing the facilities, systems, and components to appropriately mitigate those hazards;
4. developing operational controls for hazards that cannot be eliminated through design features;
5. operating the facility in accordance with prescribed limits and procedures; and
6. assessing system effectiveness in order to support continuous improvement.

Implementation of ISMS by the project is described in more detail in the NSLS-II ES&H Plan.

B5.3 Waste Minimization and Pollution Prevention

NSLS-II will establish, document, implement, and continually improve an environmental management system in accordance with the requirements of Integrated Safety Management and the International Standard ISO 14001. Through this program, NSLS-II will integrate environmental stewardship into all facets of the facility's mission. BSA is committed to managing programs in a manner that protects the ecosystem and public health.

B5.4 Permitting and Licensing

An objective of the NSLS-II Project is to minimize the risk of cost increases and schedule delays associated with permitting and licensing processes. Permitting requirements will be defined early in the project, technical information needed for permit application will be developed in a timely manner, and completed applications will be filed at times supporting the project schedule. Appropriate applications will be filed with local, state, and federal agencies for such things as air quality, water quality, solid waste disposal, transportation, air navigation obstructions, etc.

B5.5 Construction and Industrial Safety

The contractor shall compile an appropriate listing of environment, safety, and health (ES&H) standards for construction activities. The NSLS-II Federal Project Director and DOE Facility Representative, as well as senior NSLS-II contractor management, will provide independent inspection and assessment of safety program implementation.

The NSLS-II Project Offices shall maintain procedures to restrict access to construction sites to essential personnel with appropriate training and qualifications. Access of DOE personnel to construction site(s) managed by the NSLS-II Project Office for oversight purposes shall only be with approval of the Federal Project Director or the BHSO Manager. The FPD shall provide advance notification to the Project Office of DOE personnel authorized to enter construction area(s). A log shall be maintained to document details of all DOE oversight visits. DOE oversight personnel authorized to enter construction areas shall have stop work authority for imminent hazard conditions. Where other concerns or questions arise DOE personnel should communicate these to the Federal Project Director and the BSA ES&H Manager.

B5.6 Safety Approvals for Commissioning

Throughout the commissioning period and later into operations, authority to operate all NSLS-II systems will be granted under DOE Order 420.2B *Safety of Accelerator Facilities*. The key documents and actions described below are approved by the BHSO Manager.

The phased commissioning of facility systems occurs as equipment and utility services are placed into service. Commissioning begins with the electron source, progresses through the linac, and finally to the storage ring systems. Commissioning of the beamlines and instruments is a post-project activity. A Commissioning Program Plan will be developed to describe the objectives of each phase of commissioning. This plan will call for sequential commissioning modules, beginning with the electron source and concluding with storage ring commissioning.

All accelerator-commissioning activities will be conducted as prescribed in the Commissioning Plan and within the boundaries defined in an applicable Accelerator Safety Envelope (ASE). The ASE is based on a detailed Safety Assessment Document (SAD), which describes in sufficient detail all significant hazards presented by the commissioning operations and the controls by which these hazards will be managed. The SAD defines the controls and standards that must be incorporated into the facility design and operating procedures. It provides the basis for the ASE that must be prepared and approved by BNL and DOE management prior to commissioning. Since accelerator subsystems will be commissioned in successive sequences (first linac, then booster, and finally storage ring), approval to commission each subsystem will require the appropriate SAD and ASE prior to the start of commissioning. A complete facility Final SAD (or FSAD) and ASE must be completed and approved prior to CD-4 approval.

Accelerator Readiness Reviews (ARR) must be performed before approval for accelerator commissioning is given. An ARR is conducted to verify the necessary safeguards and procedures are in place to permit safe operation of the facility or sub-facilities. Where commissioning of an accelerator facility is accomplished in phased and discrete segments, the ARR must also be performed incrementally. All accelerator readiness reviews will be conducted as described in DOE Order 420.2B *Safety of Accelerator Facilities* and the BNL Accelerator Safety Subject Area. The scope and schedule of each commissioning module will be established in the Plan of Action prepared for the commissioning module. The NSLS-II Federal Project Director will monitor and/or arrange DOE participation in the ARR, and will obtain BHSO Manager authorization for the module's commissioning and routine operations after determining that documentation and readiness are acceptable.

B6. RESOURCE PLANNING

See Section 6, Resource Planning, of the PEP base document for the planned funding profile.

For BHSO, the Federal Project Director leads a project office with a dedicated full-time staff to oversee and direct project activities, relying on part-time BHSO matrix staff for supplemental support. The DOE BHSO NSLS-II Project Office will have a peak staff of approximately three directly assigned individuals. This office will be supplemented by part-time matrix support estimated at a maximum of approximately five full-time equivalents (FTEs). The matrix personnel resources are provided primarily through staff assignments from various BHSO organizations. Matrix support is also available from the Chicago Office, which serves as an SC support office.

B7. TRANSITION TO OPERATIONS

B7.1 Systems Turnover

As buildings, utilities, and technical equipment are completed, delivered, installed, etc., the Accelerator Systems Division (ASD), Experiment Facilities Division (XFD), and Conventional Facilities Division (CFD) will assume responsibility for testing, acceptance, operation, and maintenance of their respective equipment or buildings.

B7.1.1 As-Built Design Documentation

Equipment suppliers should deliver final design documents for the NSLS-II facility in stages throughout the project. ASD, XFD, and CFD should assure that these drawings and specifications are provided with delivery of equipment and systems, and will assume full responsibility for maintaining the design information as current, including engineering changes or subsequent system modifications.

B7.1.2 Operations & Maintenance Manuals

Equipment suppliers are responsible for preparing appropriate operating and maintenance manuals for the systems that they deliver. ASD, XFD, and CFD should assure these manuals are provided with delivery of equipment and systems, and will assume full responsibility for maintaining currency of those manuals.

B7.1.3 Installation, Testing, and Acceptance of Equipment and Systems

ASD, XFD, and CFD will install and/or test equipment, systems, and buildings delivered. During installation and testing, defects (due to design, manufacture, or shipment) are to be identified for corrective action. Properly functioning items and/or systems will be "accepted" by ASD, XFD, or CFD, who at that point assume full responsibility for operation and maintenance.

B7.1.4 Training and Qualifying Operators

Training of the operations and technical staff will be consistent with the relevant sections of the operations and maintenance manuals for the equipment they will be operating. Objectives for this training will be to safely and efficiently operate equipment and systems for which they are responsible, and to provide proper maintenance of the equipment and systems.

B7.2 Operations Phase

As indicated in Section 9 (NSLS-II Project Tailoring Strategy) of the PEP base document and Section A7 of Appendix A, for project completion (CD-4), NSLS-II must have in place all capital facilities defined in the WBS Dictionary, the current version (to Level 3) of which is contained in Appendix D and is under change control as defined in Section 8 of the PEP base document, and have conducted initial performance tests to demonstrate operation to meet the Threshold Key Performance Parameters at Project Completion in Table 4.4.1 in the PEP base document. After completion of the Level 1b milestone L100060, "BOD of

Experimental Floor Space", beamlines and experimental equipment will be installed on the experimental floor. Following CD-4, Approve Project Completion, a period of continued shake-down of facility systems will take place, including integrated testing and commissioning of scientific instruments, which is expected to last one to two years.

B8. PERFORMANCE BASELINE AND CHANGE CONTROL

Change control thresholds are defined in Section 8 of the PEP base document. The Federal Project Director reviews proposed baseline changes and provides approval or rejection for Level 2 changes and concurrence or rejection for Deviations and Level 1 changes. Level 2 milestones are listed in Table B4.1. The cost elements under FPD control, i.e. the BAC for the Level 3 WBS elements, are listed in Table B8.1.

The Federal Project Director will be supported by a board consisting of the Program Manager, the Deputy Federal Project Director and other personnel as needed. The board is advisory with final approval authority residing with the Federal Project Director.

Table 8.1 NSLS-II Project Level 3 WBS Element BAC

WBS #	TITLE	BAC
1.01	**PROJECT MANAGEMENT**	
1.01.01	Project Management	$ 6,692,091
1.01.02	Environmental, Safety & Health	$ 6,154,591
1.01.03	Project Support	$ 36,375,557
1.01.04	Quality Assurance	$ 3,073,212
1.01.05	Configuration Management & Document Control	$ 1,972,567
	Level 2 Total:	**$ 54,268,018**
1.02	**R&D and CONCEPTUAL DESIGN**	
1.02.01	Accelerator Systems R&D	$ 11,460,076
1.02.02	Experimental Systems R&D	$ 19,166,553
1.02.03	Conceptual Design - Accelerator Systems	$ 12,998,214
1.02.04	Conceptual Design - Experimental Facilities	$ 709,445
1.02.05	Conceptual Design - Conventional Facilities	$ 3,886,952
1.02.06	Conceptual Design - Project Management & Support	$ 7,086,188
1.02.07	Project Management R&D	$ 5,305,339
	Level 2 Total:	**$ 60,612,767**
1.03	**ACCELERATOR SYSTEMS**	
1.03.01	Accelerator Systems Management	$ 6,019,099
1.03.02	Accelerator Physics	$ 10,071,767
1.03.03	Injection System	$ 39,969,095
1.03.04	Storage Ring	$140,738,451
1.03.05	Controls Systems	$ 20,121,954
1.03.06	Accelerator Safety Systems	$ 4,297,433
1.03.07	Insertion Devices	$ 25,237,478
1.03.08	Accelerator Fabrication Facilities	$ 5,722,387
	Level 2 Total:	**$252,177,664**
1.04	**EXPERIMENTAL FACILITIES**	
1.04.01	Experimental Facilities Management	$ 4,568,673
1.04.02	Standard Local Controls & Data Acquisition Systems	$ 69,585
1.04.05	User Instruments	$ 63,573,084
1.04.06	Front End User Requirements Development	$ 456
1.04.07	Optics Labs	$ 2, 072,162
	Level 2 Total:	**$ 70,283,960**
1.05	**CONVENTIONAL FACILTIES**	
1.05.01	Conventional Facilities Management	$ 14,187,003
1.05.02	Conventional Facilities Engineering and Design	$ 20,673,299
1.05.03	Conventional Facilities Construction	$217,414,846
1.05.04	Integrated Controls & Communications	$ 561,273
1.05.05	Standard Equipment	$ 1,025,586
1.05.06	Conventional Facilities Commissioning	$ 578,000
	Level 2 Total:	**$254,440,007**
1.06	**PRE-OPERATIONS**	
1.06.01	Pre-Operations Management	$ 20,170,700
1.06.02	Accelerator Systems - Pre Ops	$ 17,071,591
1.06.03	Experimental Facilities - Pre Ops	$ 3,823,660
1.06.04	Spares	$ 9,134,454
	Level 2 Total:	$ 50,200,405
	Total BAC	**$741,982,821**

NATIONAL SYNCHROTRON LIGHT SOURCE II
PROJECT EXECUTION PLAN

APPENDIX C – NSLS-II PROJECT OFFICE PLANS AND CONTROLLED ITEMS

Steve Dierker 10/27/09

Steven B. Dierker
NSLS-II Project Director

Date

The contents of this PEP section are under the purview and control of the BNL NSLS-II Project Director, who must approve and sign all changes.

CHANGE SYNOPSIS FOR APPENDIX C

Revision	Effective Date	Summary of Change
0	October 17, 2007	Updated Preliminary Project Execution Plan to Project Execution Plan in support of the Critical Decision 2 (CD-2) review and approval process.
1	November 16, 2007	Organization chart updated.
2	September 29, 2008	Updated Section C4.1 Organization and Responsibilities. Organization chart updated.
3	September 30, 2009	Updated Organization chart Deleted text on Assistant Project Director for Conventional Consturction. Updated description on PAC

NATIONAL SYNCHROTRON LIGHT SOURCE II PROJECT EXECUTION PLAN APPENDIX C

C1. INTRODUCTION

This Appendix C of the National Synchrotron Light Source II (NSLS-II) Project Execution Plan (PEP) describes the project team organization structure and responsibilities, and project management systems that will be used to control day-to-day activities of the project. This section does not repeat information included in the other appendices or information contained in other project documents. Changes to this appendix are approved by the NSLS-II Project Director, although all revisions are provided to the NSLS-II Federal Project Director.

C2. MISSION NEED AND JUSTIFICATION

See Section 2, Mission Need and Justification, of the PEP base document.

C3. PROJECT DESCRIPTION

See Section 3 of the PEP base document, Project Description.

C4. MANAGEMENT SYSTEMS

This section describes the integrated systems used to manage the project's cost and schedule performance and technical accomplishments. Although the systems are described separately, they are mutually supportive and are employed in an integrated manner to achieve project objectives. As conditions change during the evolution of the project, the systems will be modified appropriately to remain responsive to the needs for project control and reporting. The project management, measurement, planning, and control systems employed by the NSLS-II Project are consistent with DOE guidelines and established best practices.

C4.1 Organization and Responsibilities

The NSLS-II Project is being carried out by the NSLS-II Project Organization.

C4.1.1 Participant Responsibilities

The organization of the project team is shown in Figure C-1. The roles and responsibilities of the key positions shown on the chart are as follows.

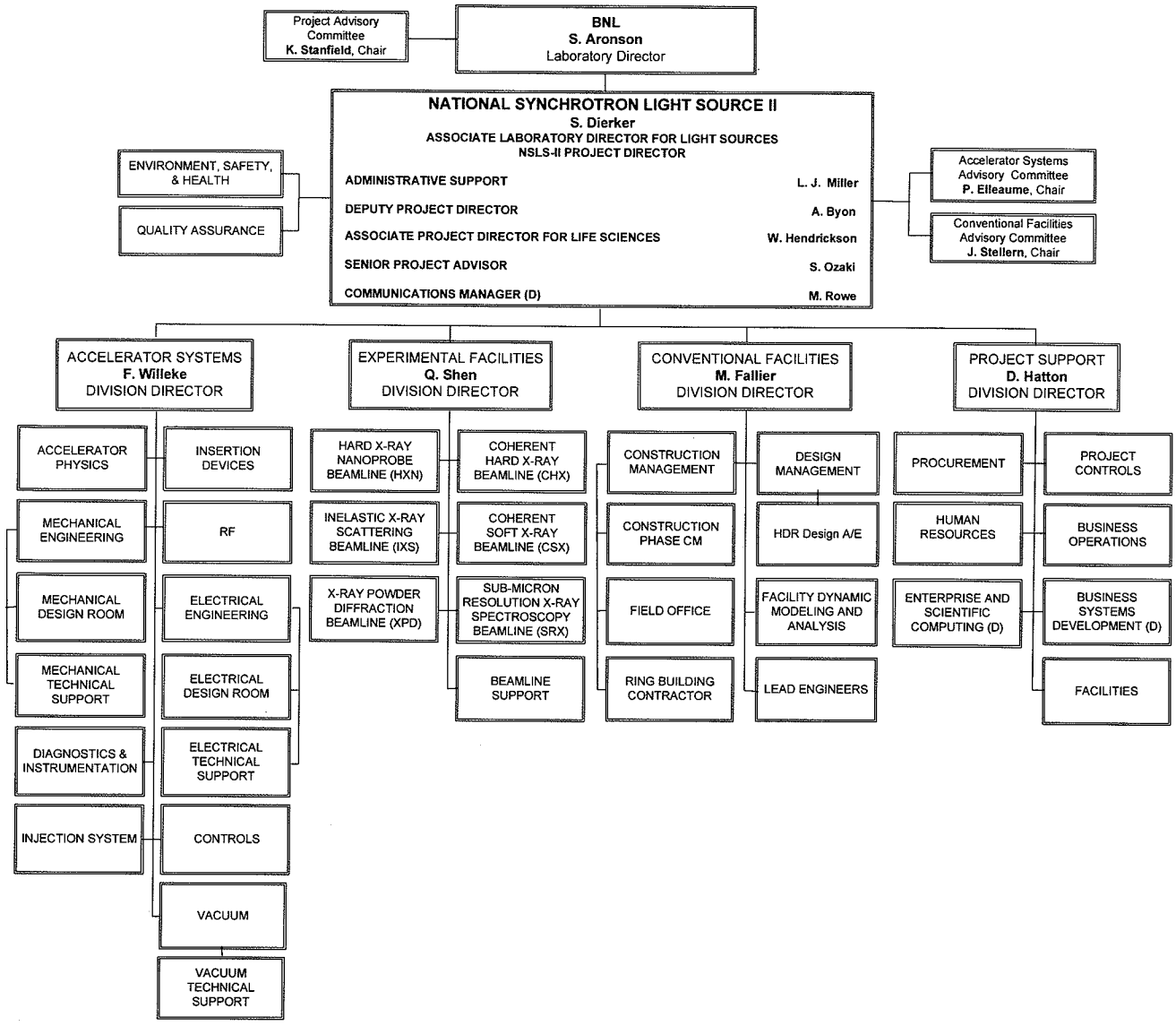

Figure C-1 NSLS-II Organization Chart

Project Director – The NSLS-II Project Director is responsible for the overall successful execution of the NSLS-II Project, including:

- provide executive-level management of the design, construction, and transition to operations of the NSLS-II facility to ensure all mission requirements are fulfilled in a safe, cost-efficient, and environmentally responsible manner;
- maintain primary responsibility to work with the scientific user community to ensure NSLS-II meets user needs, and provide leadership to the synchrotron community to develop new opportunities in synchrotron science and its applications;

- exercise full financial authority and accountability as delegated by DOE to develop budgets and control the NSLS-II work within approved baselines, and control changes to approved baselines in accordance with established configuration management procedures;
- manage and direct procurements within the authority delegated by DOE, including the authority to execute and deliver contracts, agreements, teaming agreements, purchase orders, assignments, and instruments and documents of any kind relating to the acquisition, or disposition of products, services, materials, supplies, and equipment relating to and necessary and desirable for completion of the NSLS-II Project;
- maintain overall responsibility to hire and manage the human resources necessary to complete the NSLS-II Project and ensure an effective transition to operations within the authority delegated by DOE; and
- maintain a relationship with the foreign synchrotron communities that are designing and operating similar facilities, to keep informed of current progress and developments of potential significance to NSLS-II.

Deputy Project Director – The NSLS-II Deputy Project Director reports directly to the NSLS-II Project Director and is a key member of the executive management team consisting of the Project Director, Deputy Project Director, and Division Directors. Responsibilities include:

- carrying out the NSLS-II Project Director functions when the Project Director is unavailable;
- providing support for all the functions performed by the NSLS-II Project Director;
- day-to-day project management of the NSLS-II Project, ensuring that the project is completed safely, on time, and within budget;
- providing overall direction for project planning, scheduling, and budgeting and overseeing the NSLS-II project management functions;
- providing overall direction for the NSLS-II procurement strategy;
- defining estimating rules, practices, and procedures and managing periodic project re-estimates;
- establishing, maintaining, documenting, and enforcing sound management and configuration control standards;
- implementing, together with the Project Director and Division Directors, all approved baseline technical/design basis changes to the official NSLS-II project technical baseline documents and supporting technical design documents;
- developing the overall risk management approach for the Project, including the scheduling of routine reviews related to project risk, assuring that risk analysis results are documented, and that risk mitigation plans are brought to closure; and
- serving as a member of the Integrated Project Team.

The Deputy Project Director carries out the duties of the Project Director when the Project Director is unavailable and provides support for all of the functions performed by the Project Director.

Environment, Safety, and Health (ES&H) Manager – The Project Director will exercise line responsibility for safety on the project and has appointed an ES&H Manager to guide the organizational elements in their respective safety efforts. The ES&H Manager reports to the Project Director and is responsible for:

- providing overall policy and guidance on ES&H issues;
- working with the line organizations to make available necessary input from ES&H professionals and other support;
- ensuring integration of ES&H factors into design, installation, commissioning, and operations;
- ensuring timely initiation of operational and accelerator readiness reviews;
- regularly assessing the effectiveness with which ISMS is being applied;
- coordinating the ES&H assessments conducted by others;
- assuring compliance with BNL and OSHA regulations;
- after an event, overseeing and coordinating adherence to required procedures in reporting abnormal events or conditions following the BNL SBMS Subject Area: Occurrence Reporting and Processing Systems; and
- generating and obtaining appropriate approvals for safety documentation, including:
    - NSLS-II Environment, Safety, & Health Plan
    - NSLS-II Project Construction ES&H Plan
    - NSLS-II Preliminary Hazard Analysis
    - NSLS-II Final Hazard Analysis
    - NSLS-II Preliminary Safety Assessment Document
    - NSLS-II Final Safety Assessment Document
    - NSLS-II Accelerator Safety Envelope
    - NSLS-II Occurrence Reporting Policies and Procedures
    - Other documents and procedures as required.

Quality Assurance (QA) Manager – The Quality Assurance Manager reports to the Project Director and is responsible for:

- planning, generating, and obtaining approval for QA requirements and documentation, including the NSLS-II Quality Assurance Plan
- providing consultation to system managers to implement QA-related activities;
- providing project-specific QA training to system managers on this QA Plan and other topics that may be of interest to the project personnel;
- reviewing completion of QA-related milestones as provided in project schedules, and report results to project management;
- performing QA surveillance and/or audits;
- working with the Project Director to prevent situations where completion of critical planned QA activities are compromised due to cost, schedule, or other constraints;
- making recommendations to the Project Director when work should be stopped based on an investigation indicating that quality is inadequate as defined in this QA Plan; and
- participating individually or as part of a team in vendor surveys, vendor qualifications, and source inspections.

Accelerator Systems Division Director – Reports to the Project Director and is responsible for:

- oversight and management of scientific, engineering, and technical staff for all aspects of accelerator systems, including storage ring, injector system, and insertion devices;
- directing the development of, and approving the plans, schedule, costs, and milestones for, R&D activities within the Accelerator Systems Division;
- directing the design, fabrication, installation, testing, and commissioning of accelerator systems; and
- executing their respective portion of the project safely and within approved budget and schedule.

Interface Manager - Reports to the Accelerator Systems Division Director and is responsible for:

- interactions and coordination of interface issues with the Conventional Facilities and Experimental Facilities Divisions by representing the Accelerator Systems Division;
- identifying and resolving interface issues by organizing discussions and task forces within the Accelerator Systems Division; and
- development and update of relevant project-wide interface documents for Accelerator Systems.

Group Leaders - Report to the Accelerator Systems Division Director and are responsible for:

- management of the group team members to deliver design and construction of the relevant accelerator component with performance in accord with specifications and requirements, including cost, technical, schedule, quality, and safety objectives;
- coordination of work plan and verification of progress of the tasks which are assigned to the group;
- organization and prioritization of the work load and task assignments among the group staff members in order to meet the objectives of the cost plan and the schedule of the project; and
- supervision of the group staff members, including task hiring, performance appraisals, and request for promotions.

Coordinators - Report to the Accelerator Systems Division Director and are responsible for:

- coordination of the relevant technical groups in designing, assembling, installing, integrated testing and commissioning of the assigned subsystems;
- interactions and coordination of interface issues with other subsystems within the Accelerator Systems Division;
- identifying and resolving those interface issues by organizing discussion and task forces within Accelerator Systems Division; and
- development and update of relevant interface documents for the assigned subsystems.

Experimental Facilities Division Director – Reports to the Project Director and is responsible for:

- oversight and management of scientific, engineering, and technical staff and for all aspects of experimental facilities, including R&D and beamline and instruments systems;
- establishing and coordinating the science programs for NSLS-II, including outreach to the scientific community, to ensure maximum scientific productivity of NSLS-II and that the project is responsive to user needs;
- directing the development of, and approving the plans, schedule, costs, and milestones for, R&D activities within the Experimental Facilities Division;
- directing the design, fabrication, installation, testing, and commissioning of the beamline and instrument systems; and
- directing and executing the respective portion of the project safely and within approved budget and schedule.

Interface Manager - Reports to the Experimental Facilities Division Director and is responsible for:

- interactions and coordination of interface issues with the Conventional Facilities and Accelerator Systems Divisions by representing the Experimental Facilities Division;
- identifying and resolving interface issues by organizing discussions and task forces within the Experimental Facilities Division; and
- development and update of relevant project-wide interface documents for Experimental Facilities.

Beamline Manager - Reports to the Experimental Facilities Division Director and is responsible for:

- coordination of beamline technical design and engineering tasks with scientists and engineers both within and external to the Experimental Facilities Division;
- identifying and resolving technical issues by organizing discussions and interactions both within Experimental Facilities Division and with commercial vendors; and
- providing support to Division Director in areas of workforce recruitment and interfacing with project control documentation and management.

Group Leaders - Report to the Experimental Facilities Division Director and are responsible for:

- interacting with the user community, including the beamline advisory team, for developing and establishing a scientific user program at the beamline of responsibility;
- management of group members to deliver design and construction of the beamlines and instruments in accord with specifications and requirements, including cost, technical, schedule, quality, and safety objectives.;
- coordination of work plan and verification of progress of the tasks which are assigned to the group;
- organization and prioritization of the work load and task assignments among the group staff members in order to meet the objectives of the cost plan and the schedule of the project; and
- supervision of the group staff members, including task hiring, performance appraisals, and request for promotions.

Conventional Facilities Division Director – Reports to the Project Director and is responsible for:

- directing the design and construction of the facilities required for housing and serving the technical systems and research equipment;
- ensuring that the design and construction are within approved budget and schedule and meet applicable technical, environmental, and safety standards and requirements;
- managing the efforts of the AE firm to perform Title I and Title II design and provide Title III design support during construction;
- administering the technical terms of the construction contracts and contracts with independent testing laboratories;
- assuring that all contractors and vendors for conventional facilities perform in accordance with the terms of their contracts and purchase orders, including ES&H and quality requirements; and
- coordinating with BNL Plant Engineering on matters related to conventional facilities.

Conventional Facilities Assistant Director for Design Management - Reports to the Conventional Facilities Division Director and is responsible for:

- management, coordination and oversight of all conventional facilities design including management of design performed by architect engineering (AE) firms and design support by in-house project staff and BNL departments such as Plant Engineering Division;
- integration of design with Accelerator Systems and Experimental Facilities Divisions and development and update of requirements documents forming basis for conventional facilities design;
- maintaining design configuration during design and construction, preparation of engineering changes to contract drawings and update of construction drawings to as-built condition at construction completion;
- coordinating effort of A/E and project engineering staff to review contractor submittals to support construction schedule and, in concert with CFAD for Construction Management, to verify proper execution of design; and
- maintaining all design record documents.

Conventional Facilities Assistant Director for Construction Management - Reports to the Conventional Facilities Division Director and is responsible for:

- management, coordination and oversight of all construction work performed for conventional facilities including the work of outside contractors and in-house trade personnel;
- oversight of constructability reviews and cost estimate preparation during design phase;
- development and management of construction inspection team to verify all construction is performed in accordance with design plans, specifications and contractual requirements including technical, quality, schedule and safety objectives;
- oversight and directing all contractor work in the field by performance of regular inspections, verification of testing, coordination of work planning and permits, review and verification of progress payments, and verification of performance of all engineering change notices and contract changes; and
- contract closeout and maintenance of all contractor correspondence and documents.

Project Support Division Director – Reports to the Project Director and is responsible for provision and coordination of administrative and project support activities across the project. Project staff who report to the Project Support Division Director provide support to the entire project. The functions within the Project Support staff are as follows.

Business Manager – Responsible for financial management, planning, and reporting. Provides accounting support.

Procurement Manager – The responsibilities of the Procurement Manager include:

- managing the procurement process, including planning, coordination, and implementation;
- providing contract administration of the Conventional Facilities contracts, including the AE and CM;
- establishing project-wide contracts for standardized procurements; and
- assisting, reviewing, and evaluating contractor procurement operations.

Human Resources Manager – Responsible for assisting the NSLS-II Project for the successful delivery of on-site human resources services, including workforce planning, recruiting, hiring, and retention of a diverse and highly qualified team.

Project Controls Manager – Responsible for:

- project control functions, including:
  - cost and schedule development,
  - implementation and maintenance of the Performance Baseline and earned value management system,
  - coordination, review, and maintenance of the baseline change control process, and
  - project progress reporting.

Enterprise and Scientific Computing Manager – Responsible for establishing, implementing, and maintaining all aspects of enterprise and scientific computing support, including servers and networks. Responsible for computer security. Provides oversight and direction to subcontractor information technology programs.

Business Systems Development Manager – Responsible for development, installation, and maintenance of business information systems.

Facilities Manager – Responsible for coordination of non-project operations issues that affect buildings occupied by project staff, such as utility shutdowns, maintenance activities, and construction projects, to ensure the safe and efficient operation of the facilities.

C4.1.2 Advisory Committees

Several advisory committees are represented by the blocks on Figure C-1. Three committees provide managerial and technical assistance to the project team on Accelerator Systems, Experimental Facilities, and Conventional Facilities. Additionally, the Project Advisory Committee and the Laboratory Director of BNL will provide regular oversight of the project. The roles of these committees are as follows:

Project Advisory Committee (PAC) – The members of the Project Advisory Committee are charged to review the progress of the NSLS-II and to advise the BNL Laboratory Director and the Project Director on matters related to construction planning, project management, technical performance, and safety. The Project Advisory Committee (PAC) will provide continuity of oversight of the NSLS-II project on behalf of the Laboratory Director of BNL until the end of construction. The PAC will identify and bring to the attention of the Laboratory Director of BNL any issues whose resolution is critical to the technical success of the project and to meeting project cost and schedule goals. The Project Director will work with the PAC Chair to schedule periodic meetings and develop agendas. The committee will report its findings and recommendations to the BNL Laboratory Director.

Accelerator Systems Advisory Committee (ASAC) – This committee will be composed of external experts trained in accelerator physics and engineering who are familiar with the design, construction, and operations of major accelerator systems. This group will provide advice and guidance to the NSLS-II accelerator team on technical choices, trade-offs, and decisions; value engineering; measures to improve availability and reliability of operations; diagnostics and controls; etc. The Director of the Accelerator Systems Division will work with the ASAC Chair to schedule meetings and develop agendas. The committee will report its findings and recommendations to the Project Director.

Science Advisory Committee (SAC) – This committee will be composed of external experts in major science programs, technical developments, and facilities and program management.. This group will provide advice and recommendations on all scientific and policy issues that bear on the full and effective utilization of NSLS-II and on future developments required to maintain the scientific productivity of NSLS-II programs at the highest possible level.. The SAC will also provide advice and guidance on the choice of instruments to build at NSLS-II, assist in forming the teams to build these instruments, and generally provide direction to the formation of the experimental facilities at NSLS-II. The Associate Laboratory Director for Light Sources will work with the SAC Chair to schedule meetings and develop agendas. The committee will report its findings and recommendations to the Associate Laboratory Director for Light Sources.

Conventional Facilities Advisory Committee (CFAC) – This committee will be composed of external experts trained in conventional construction, most of whom have had extensive experience in designing and constructing conventional facilities and the supporting infrastructure associated with major scientific user facilities. This group will provide advice and guidance to the NSLS-II conventional facilities team on the development of the improvements to land, conventional construction, and utilities systems required to deliver the maximum benefit to the users. The Director of the Conventional Facilities Division will work with the CFAC Chair to schedule meetings and develop agendas. The committee will report its findings and recommendations to the Project Director.

Beamline Advisory Teams (BAT) – These teams will be formed by submitting a Letter of Interest (LOI) to help refining the scientific mission and technical requirements for each beamline. The LOI submitted by the BAT will be reviewed by the SAC. The recommendations from the SAC on the scientific and technical assessments of the LOI will be submitted to the Project Director for the final selection. Each selected BAT will represent a particular user community with extensive scientific and technical experience in designing, constructing, and operating synchrotron beamlines and/or instrumentation and conducting experiments. Each BAT reports to the Experimental Facilities Division Director and meets every 6 months, working closely with the Experimental Facilities Division to advise them during design, construction, commissioning, and early operations.

C4.2 Work Breakdown Structure

The Work Breakdown Structure (WBS) diagram and Dictionary are defined in Appendix D. The detailed technical baseline will be maintained in the NSLS-II WBS Dictionary, the NSLS-II Global Parameters List, the NSLS-II Global Requirements Document and the Requirements, Specifications and Interface documents. The WBS Dictionary entries for Levels 1, 2, 3, and 4 (see Section 4.2 of the PEP base document, for Level 2) are placed under configuration control.

The WBS is structured according to the follow level classification:

- WBS Level 1 – NSLS-II Project
- WBS Level 2 – Major subsystem
- WBS Level 3 – Class of component
- WBS Level 4 – Specific component in class
- WBS Level 5 – Specific part or operation required to realize component

Lower levels will be developed as needed.

C4.3 Acquisition Strategy

See Section 4.3 of the PEP base document and Section B4.3 of Appendix B.

C4.4 Work Authorization and Management of Funds

Sections A4.4 and B4.4 of Appendices A and B, respectively, of this PEP describe the DOE to BSA work authorization process for the project. For authorization within the BSA, the Project Office will develop standard work/funding package formats, provide assistance when needed, and perform other project-wide management and administration. The Directors of the Accelerator Systems, Experimental Facilities, and Conventional Facilities Divisions and their teams will prepare work plans and provide data to the Project Support Division. The *NSLS-II Project Controls Manual* details the roles of project participants in the assignment of work and the funding process.

C4.5 Project Summary Schedule

The schedule baseline for the NSLS-II Project is the detailed integrated project Schedule in Primavera , as described in the NSLS-II Project Controls Manual. Level 3 and below milestones are included in this schedule baseline.

C4.6 Financial Management

See Section B4.6 of the PEP base document. Additionally, the NSLS-II Project Organization utilizes the BSA financial management system.

C4.7 Quality Assurance

Quality assurance (QA) is an integral part of the design, procurement, fabrication, and construction phases of the project. Special attention is devoted to items that affect the operational reliability of project facilities. The *NSLS-II Quality Assurance Plan* covers all phases of the project from R&D through facility acceptance. This plan delineates the QA/quality control (QC) requirements for the project, and guidelines for how they will be satisfied, including responsibilities of project participants. The Quality Assurance Manager will maintain the *NSLS-II Quality Assurance Plan* and will perform surveillances and audits of project-wide QA management activities. Group leaders will provide QA plans, vendor surveillance, inspection, and other QA activities needed to support their respective areas.

The AE, CM, and vendors will implement QA/QC programs appropriate to the services or items being furnished. These programs, as well as implementing procedures, are subject to review and audit by the NSLS-II QA team.

C4.8 Project Monitoring, Assessment and Reviews

Reviews and meetings with DOE are described in Section 4.8 of the PEP base document, Section A4.8 of Appendix A and Section B4.8 of Appendix B of the PEP.

Formal meetings and reviews will be conducted to identify and resolve interface issues within the project. Reviews will be conducted by the Project Director, appropriate Division Directors, and the AE/CM. Formal NSLS-II meetings and reviews, including a project-wide design review program, are described in the *NSLS-II Risk Management Plan* and include the following:

1. **Executive Management Meetings** – Weekly meetings are held by the Project Director with the executive management team which includes the Deputy Project Director, and the directors of the Accelerator System Division, the Experimental Facilities Division, the Conventional Facilities Division, and the Project Support Division. These meetings are typically concerned with the following: current status of the project; NSLS-II management issues; proposed major changes in project scope, cost, or schedule; laboratory, DOE, or other actions potentially affecting the project; advisory committee involvement; user coordination; and senior-level management decision making and coordination.

2. **Cost/Schedule Project Review Meetings** – These monthly reviews are held with the NSLS-II project participants, including Project Director, Deputy Project Director, Division Directors, Group Leaders, Control Account Managers, and project controls staff. The meetings typically focus on cost and schedule, including funding changes, current-year budget status, earned value performance trends, schedule concerns, and workforce requirements.

3. **Risk Management Team Meetings** – The Risk Management Team meets biweekly to review the risk assessment process, identified risks, potential risks, risk mitigation strategies, and the progress of risk mitigation activities. The full charge and membership of the Risk Management Team are given in the Risk Management Team Charter in Appendix B of the *NSLS-II Risk Management Plan.*

4. **Change Control Board Meetings** – The NSLS-II Change Control Board meets biweekly to review and decide on all Project Change Requests and Baseline Change Proposals. The full charge and membership of the NSLS-II Change Control Board are given in the NSLS-II Change Control Board Charter in Appendix C of the *NSLS-II Configuration Management Plan.*

5. **Division Meetings** – Each Division Director holds weekly meetings with the group leaders in his/her division to disseminate information transmitted from other meetings and to address issues of concern to the division.

6. **Group Meetings** – Each Group Leader holds monthly, or as required, meetings of the group staff to disseminate information transmitted from other meetings and to address issues of concern to the group.

7. **Technical Issue Meetings** – These meetings of the Project Director, Deputy Project Director, Division Directors, and Group Leaders are held as required to disseminate technical information about the project to NSLS-II personnel as well as to others. The information includes the current status of work and outstanding issues associated with the system design, fabrication, and interface concerns.

8. **General Project Meetings** – At least twice a year principal project participants will meet to review the overall project, including the cost, schedule, and technical issues.

9. **Design Reviews:** Design Reviews are an integral part of the project and are performed by individuals external to the project. DOE O 413.3A requires that design reviews be conducted starting at CD-1 and continuing through the life of the project. For the NSLS-II Project, design reviews are organized by NSLS-II Project Director in coordination with the Federal Project Director.

The *NSLS-II Project Controls Manual* describes the project's earned value management processes and procedures and participant responsibilities. The *NSLS-II Configuration Management Plan* describes the baseline change control procedures and participant responsibilities. The earned value management system for the NSLS-II Project was developed in accordance with the BSA *Earned Value Management System Program Description* which meets the ANSI/EIA-748-A standard. Upon approval of CD-2, monthly reports of progress on the approved work plans utilizing earned value methods will be compiled and submitted by the control account managers to the NSLS-II Project Support Division. These reports shall include financial information, as well as documentation of technical progress, required deliverables and milestones.

The NSLS-II Project will utilize robust project management software systems to analyze and report technical, cost and schedule progress on a monthly basis. Reports will be provided to DOE as described in Section B 4.6 of Appendix B and detailed in the *NSLS-II Project Controls Manual.*

Anticipated or actual cost and/or schedule variances that would be in excess of thresholds established in this PEP and in the *NSLS-II Project Controls Manual* will be clearly identified and reported as soon as known. Action plans to correct the problems will be proposed, implemented, and reported on until correction is complete.

C4.9 Value Management

Value Management/Value Engineering on NSLS-II will be performed to ensure that all essential functions required by the project scope are achieved at the lowest life-cycle cost consistent with safety, performance, reliability and quality requirements. The NSLS-II Project adopts a tailored approach, characterized by:

- Use of a multi-disciplinary team following a structured plan,
- Functional analysis of all systems, equipment, facilities, services and supplies,
- Developing and evaluating new alternatives for required functions, and
- Developing, documenting and implementing recommendations.

Value engineering methods applied to the components of NSLS-II during the pre-conceptual and conceptual design process included design and trade studies that significantly shaped and influenced the development of the current design.

During the conventional facilities design, two formal VE reviews will be performed during the preliminary design (i.e., Title I) and the detailed design (Title II) phases and facilitated by an independent certified VE expert. The VE reviews will include participation of a cross disciplinary team made up of conventional facilities staff, interface managers from the accelerator and experimental facilities divisions, the design AE firm, and the construction management subcontractor. The VE process includes development of brainstorming ideas that identify a wide range of possible alternatives that are then further evaluated to determine viable cost reduction opportunities, their approximate cost impact, life cycle cost and their relative merits or drawbacks and provided to the NSLS-II Project Director for consideration, and (where feasible) incorporation into the performance baseline and design documents. A report, analysis and recommendations will be completed for each formal VE review. During the construction phase a VE incentive clause will be included in the construction contracts to encourage identification and sharing of cost savings opportunities identified by the contractor. Where implemented, VE savings may be identified as deduct change orders to the contract or may result in reduced operations costs.

The accelerator and experimental facilities design is informed by numerous technical and advisory committee reviews. The membership of the ad-hoc technical committees, design review committees, and standing advisory committees is comprised of experts in the relevant technical fields and provide critical input into the facility design influencing the optimization of performance and cost. A catalog of these reviews, the review reports, and responses to recommendations from the reviews is maintained by the NSLS-II Project.

C4.10 Public Participation

It is BNL's policy to ensure that the ideas, interests and concerns of its stakeholders are considered in program planning and decision-making processes that affect the community or the general public. This policy is intended to bring a broad range of viewpoints and values into program planning and decision-making before decisions are imminent to enable the Laboratory to make informed decisions and to build mutual understanding between the Laboratory, its stakeholders and the general public. To effect this policy, Laboratory managers will:

- Actively seek and consider public input regarding Laboratory decisions, which affect the community and the general public.
- Inform the public in a timely manner, of key upcoming decisions, progress on ongoing activities, emerging technologies, and opportunities for economic diversity, which may impact the community and the general public.
- Provide opportunities for the public to have input in an open, two-way exchange of information, knowledge and perspectives.
- Take into consideration the views of regulators, stakeholders, and the general public in making decisions.
- Provide a public account of decisions made and responses to public input regarding these decisions.
- Provide reasonable access to relevant reports, records, and documents and seek to provide non-technical explanations on technical matters when requested by the community and the general public.

Communications are conducted through a variety of mechanisms such as the BNL website the Brookhaven Bulletin, Summer Sundays, Tours, and the Speakers Bureaus. One of the most significant mechanisms is the BNL Community Advisory Council (CAC; http://www.bnl.gov/community/CAC.asp), which was formed in 1998 to provide timely and direct input on the range of issues associated with BNL, especially the environmental cleanup projects. The CAC is composed of representatives from the broad spectrum of BNL general and special interest stakeholders. The 25 member CAC holds monthly, professionally facilitated meetings. The CAC is not a site specific advisory board, as defined under the Federal Advisory Committee Act, as it is funded by Brookhaven Science Associates, and provides its input to the Laboratory Director.

C4.11 Systems Engineering

System engineering principles will be employed throughout the project, especially to ensure good interface control in the development of the project from conceptual design through turnover to operations. Systems engineering will be used to capture all significant interrelationships with internal and external factors that affect mission success.

Project-wide reliability, availability, and maintainability requirements will be determined and implemented by the Accelerator Systems Division, the Experimental Facilities Division, and the Conventional Facilities Division for equipment within their respective scope.

C4.12 Risk Management

The *NSLS-II Risk Management Plan* describes the project's risk identification and mitigation processes and participant responsibilities. These are used to evaluate the seriousness of potential project risks and to identify mitigation actions for each identified risk. The major technical risk items are discussed in Section 2.3 of the PEP base document, Project Goals and Risks of the PEP.

C4.13 Configuration Management

Configuration of the NSLS-II technical, cost, and schedule baseline and associated documents is maintained through a formal change control process. Baseline documents for the project consist of the following:

- Project Execution Plan, Appendix C
- Environmental, Safety, & Health Plan
- Environmental Assessment
- Preliminary and Final Hazard Analysis
- Preliminary and Final Safety Assessment Documents
- Quality Assurance Plan
- Risk Management Plan
- Configuration Management Plan
- Project Controls Manual
- Global Parameters list
- WBS
- WBS Dictionary
- Global Requirements Documents
- Master Site Plan
- Requirements, Specifications and Interface Documents
- Drawings and Specifications
- Approved Project Change Requests (PCRs) and Baseline Change Proposals (BCPs)

The NSLS-II configuration management system is fully described in the *Configuration Management Plan.*

C4.14 Document and Records Management

The document and records management system will be established by the Configuration Manger, and administered by the Documents and Records Administrator. The Project Support Division will coordinate project-wide information technology and information management systems. Division Directors will provide electronic files for their work scope for input to the project systems.

Intellectual property such as patents, trademarks, copyrights, and other forms of comparable property rights protected by federal law will be identified by all participants in accordance with BNL policies and will be tracked by the Project Support Division.

C4.15 Research and Development Activities Management

At the beginning of each fiscal year, available R&D funds for the project are allocated to the NSLS-II. Then, the NSLS-II Project Director, in consultation with the Division Directors, conducts the budgeting process of various R&D activities. Responsibility and authority for managing day-to-day activity for the R&D program resides with the Division Directors. The plans, schedules, costs, and milestones are approved by the responsible Division Director. The Deputy Project Director distributes the R&D funding and audits the performance of these activities through meetings and monthly cost reports.

C5. ENVIRONMENT, SAFETY AND HEALTH

NSLS-II will be designed, constructed, and operated in such a manner to protect the safety, security and health of workers, the public, and the environment in all activities carried out by the project and its contractors. This will be accomplished by:

- preparation of appropriate National Environmental Protection Act documentation;
- designing, procuring, constructing, commissioning, and operating the facility in accordance with the Integrated Safety Management System (ISMS) plan;
- designing systems and structures to minimize waste generation and to accommodate decontamination and decommissioning;
- preparation of appropriate safety documents for all systems, structures, and components; and
- implementation of effective safety programs to govern construction on the NSLS-II site.

The ES&H Manager is responsible for safety analyses, determining hazard classification, generating safety assessment documents and safety analysis reports, and obtaining appropriate approvals. The ES&H Manager is also responsible for obtaining environmental licenses and permits for the NSLS-II Project ES&H requirements as described in the *NSLS-II ES&H Plan.*

The NSLS-II Project incorporates high performance sustainable building considerations in accordance with the guiding principles of Executive Order 13423 as described in Section 5.5 of the PEP base document.

C6. RESOURCE PLANNING

See Section 6, Resource Planning, of the PEP base document.

C7. TRANSITION TO OPERATIONS

An NSLS-II Pre-Installation Policy and Requirements document will be prepared to communicate policy/requirements and assign responsibilities for the receipt and management of technical components and documents in order to ensure readiness for installation. All NSLS-II divisions are responsible for the implementation of this policy.

Hand-off agreements will be developed between the NSLS-II divisions, providing details of responsibilities and the materials, equipment, documentation, etc. to be delivered for the transition from construction to operations.

Components, subsystems, and systems will be turned over to Operations at the completion of installation and acceptance testing. A variety of procedures and division-specific plans will be developed to provide details of responsibilities and to describe the materials, equipment, documentation, etc., to be turned over for operations:

- NSLS-II Pre-installation Policy and Requirements
- NSLS-II Accelerator Turnover Plan
- NSLS-II Accelerator Systems Division Installation Plan
- NSLS-II Accelerator Systems Division Commissioning Program Plan
- NSLS-II Experimental Facilities Division Instrument Systems Integrated Installation Plan

C8. PERFORMANCE BASELINE AND CHANGE CONTROL

The project technical, cost, and schedule baseline has been developed to support CD-2. When changes become necessary, the change control process will be used, as defined by Section 8 of the PEP base document and detailed in the *NSLS-II Configuration Management Plan*.

C8.1 Technical

The detailed technical baseline will be maintained by the Division Director in the NSLS-II WBS Dictionary, the NSLS-II Global Parameters List, and the NSLS-II Global Requirements Document. Requirements for each work area will be provided and maintained by the appropriate design team.

Other, lower level, technical baseline documents include Requirements, Specifications, and Interface Documents. These provide further definition of the technical baseline and are also controlled by the configuration management system.

C8.2 Cost

The cost baseline has been developed to support approval of CD-2 and is contained in the Cobra cost processor, as described in the NSLS-II Project Controls Manual. A description of budget development and cost baseline maintenance is also described in the NSLS-II Project Controls Manual.

C8.3 Schedule

The integrated project schedule sets forth the major activities, decision points, and activity interfaces essential for completion of the NSLS-II Project. A description of schedule development and maintenance is contained in the NSLS-II Project Controls Manual.

Critical Decision and Level 1b project milestones are summarized in the base document and Appendix A of this PEP. Level 2 milestones are included in Appendix B of this PEP. Level 3 and lower level milestones are included in the Primavera schedule.

NATIONAL SYNCHROTRON LIGHT SOURCE II
PROJECT EXECUTION PLAN
APPENDIX D
NSLS-II PROJECT WORK BREAKDOWN STRUCTURE

CHANGE SYNOPSIS FOR APPENDIX D

Revision	Effective Date	Summary of Change
0	October 17, 2007	Appendix D added during update of Preliminary Project Execution Plan to Project Execution Plan in support of the Critical Decision 2 (CD-2) review and approval process.
1	November 16, 2007	Updated to include additional detail as a result of the External Independent Review performed in support of CD-2 approval. WBS Chart updated to reflect updated dictionary.
2	September 25, 2008	Updated to reflect changes required as a result of an EVMS Certification review.
3	September 30, 2009	Updated to include latest configurations and project plan.

D1. Work Breakdown Chart to Level 3

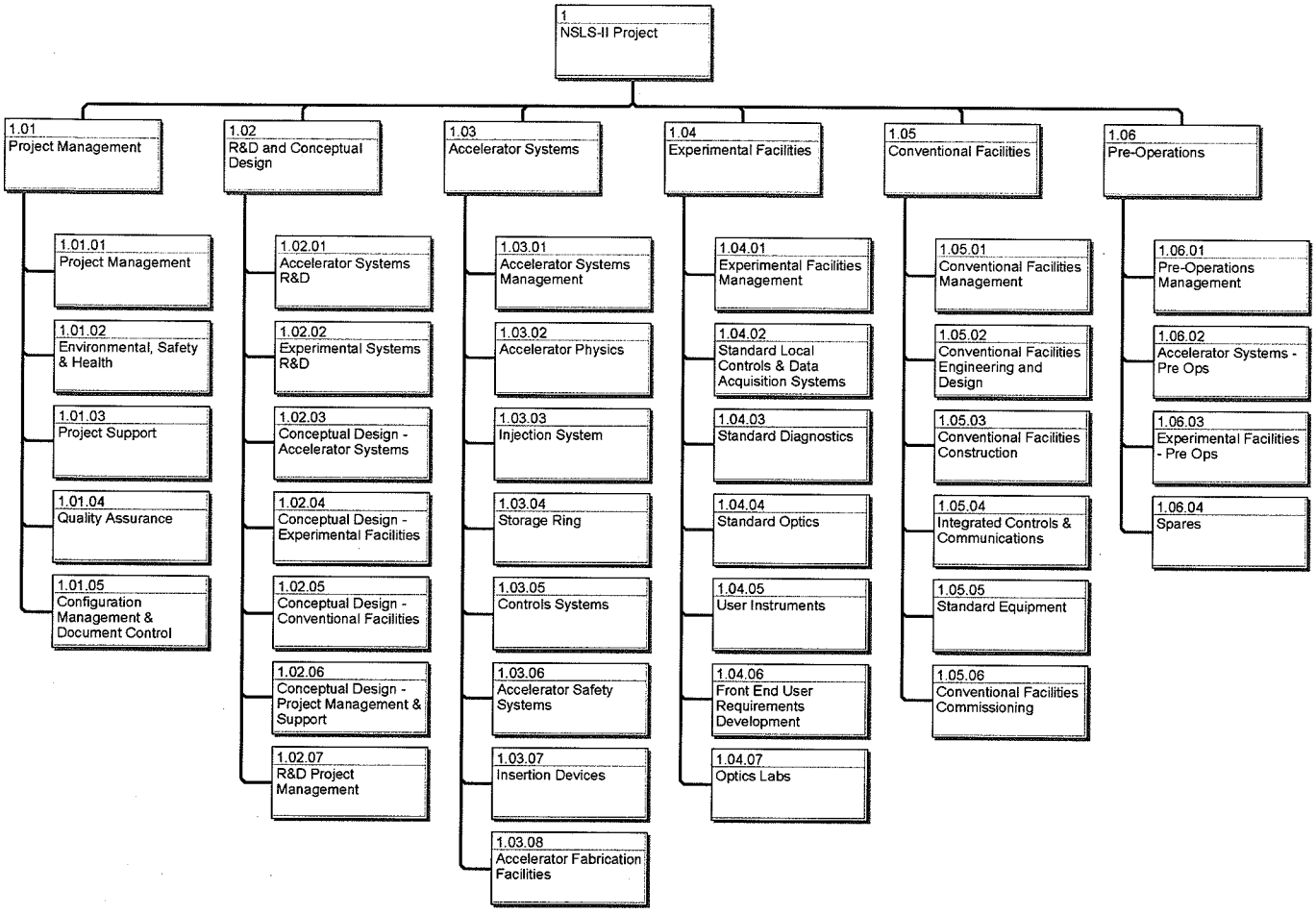

Figure D-1 NSLS-II Level 3 Project Work Breakdown Structure

D2. Work Breakdown Structure Dictionary to Level 3

1.0 NSLS-II Project - The National Synchrotron Light Source II is a highly optimized x-ray synchrotron that will be designed, constructed, and commissioned to deliver exceptional beam stability and extremely high brightness and flux; advanced instruments, optics, and detectors will capitalize on these special capabilities. A suite of the highest brightness beamlines will be instrumented as part of the Project, to enable the capability of this synchrotron facility to ultimately achieve 1 nm spatial resolution, 0.1 meV energy resolution, and single-atom sensitivity. Demonstration of these resolutions is not expected at project completion and it is expected that additional effort beyond project completion will be needed in order to achieve them.

1.01 Project Management - Perform Project Management activities to include labor, materials, travel, and fixed costs associated with operations of the NSLS-II Project Office, including the offices of the Project Director and Deputy Director; the project support functions; environment, safety, and health activities; quality assurance; configuration management; and document control.

1.01.01 Project Management - Perform project management activities and provide project support functions associated with the operations of the offices of the Project Director and the Deputy Director and the project support functions of business operations, project controls, procurement, enterprise information technology, human resources and facilities management. Also included are funds allocated to cover elements of the NSLS-II Incentive Plan, including sign-on and performance bonuses.

1.01.02 Environmental, Safety and Health - Provide Environmental, Safety and Health and ESH-training-related activities associated with the NSLS-II R&D program, construction program, and commissioning activities. It includes ESH support and oversight for all ESH issues including radiation, industrial hygiene, general safety, construction safety, and training.

1.01.03 Project Support - Provide functions including project support, financial, administrative, procurement, human resources, and other support functions for all areas of the Project. Level of Effort labor, materials, travel, building maintenance, and utilities costs for the Project office and laboratory space are included in this area.

1.01.04 Quality Assurance - Provide QA Assurance activities to ensure that a quality program is established, implemented, and maintained in accordance with Project requirements.

1.01.05 Configuration Management and Document Control - Provide Configuration Management and Document Control include activities to ensure that programs for 1) configuration management and 2) document and records management are established, implemented, and maintained in accordance with Project requirements.

1.02 R&D and Conceptual Design - Perform all Accelerator and Experimental R&D activities to support the delivery of Project objectives are captured in this WBS element. Define the NSLS-II Conceptual Design for the National Synchrotron Light Source II.

1.02.01 Accelerator Systems R&D - Perform R&D activities to support the injection system and storage ring system design are included in this WBS. Resources include labor, materials, travel, and associated costs to carry out the Accelerator Systems R&D. The seven active R&D activities are:

- Precision Alignment of the Multipoles
- Magnet Development Lab
- Corrector Magnet Study
- RF Systems Development and Demonstration
- Instrumentation R&D
- Linac Front End R&D
- Power Supply Reliability Study

1.02.02 Experimental Systems R&D - Perform research and development activities to support experimental facilities. Scope includes programs to enable the capability of this synchrotron facility to ultimately achieve 1 nm spatial resolution, 0.1 meV energy resolution, and programs to investigate thermal management issues and beam position monitors.

1.02.03 Conceptual Design - Accelerator Systems - Perform Accelerator Systems conceptual design activities associated with developing the design for the accelerator systems at NSLS-II.

1.02.04 Conceptual Design - Experimental Facilities - Perform Experimental facilities conceptual design activities associated with the development and refinement of the Advanced Conceptual Design of the beamlines for NSLS-II.

1.02.05 Conceptual Design - Conventional Facilities - Perform Conventional Facilities conceptual design activities associated with the design of the site, buildings, utilities, and infrastructure.

1.02.06 Conceptual Design - Project Management and Support - Perform Project management and support activities associated with refining both the Conceptual and Advanced Conceptual Design for NSLS-II. Resources include Level of Effort labor, materials, and travel that are dedicated to the management, oversight, and support of activities which includes preparing documentation, planning and executing project reviews, and developing the systems and establishing the organization to support the Project.

1.02.07 Project Management - R&D - Perform project management and oversight of R&D activities and provide project support functions associated with them. It includes the operations of the offices of the Project Director and the Deputy Director and the project support functions of business operations, project controls, procurement, enterprise information technology, human resources and facilities management.

1.03 Accelerator Systems - The accelerator consists of injector chain, storage ring, control system, safety systems, insertion devices, and accelerator fabrication facilities. This item also covers installation of the accelerator complex.

The injection chain is a 200 MEV S-band linac, planned as a turn-key procurement. The booster is a combined-function magnet synchrotron (158 m circumference), also planned as a turn-key procurement except for its RF system, which will be provided by NSLS-II. The system includes transfer lines that connect the linac with the booster and the booster with the storage ring.

The storage ring synchrotron (792 m long) consists of an injection section with four kicker magnets; a DC and pulsed septum; magnet system with 60 bending magnets, 300 quadrupole magnets, 300 sextupole magnets, and 210 horizontal/vertical corrector magnets; a girder system to support these magnets; power supply system that provides the magnet currents, plus 60 additional power supplies to be connected to 30 of the trim windings in the coils of the dipoles and 30 skew quadrupoles; ~792 m of aluminum vacuum chamber in 191 pieces with pumps; NEG-strips, flanges, bellows, gate valves, and diagnostics; complete beam-diagnostics system with 188 beam position monitors; RF system of one superconducting single-cell 500 MHz cavity (a second cavity is a special process spare; see 1.06.04), powered by a 300 kW turn-key klystron-based RF source and 1500 MHz passive, superconducting Landau cavity; electrical utility system supporting all these systems; mechanical utility system: a process and chilled water cooling system for cooling beam pipe and magnets; air conditioners for power supply racks; and a cryogenic system which provides cooling for the superconducting RF cavities.

Control system interfaces to all facility hardware systems (also systems outside of 1.03) to provide remote access to the hardware systems.

Safety systems: a radiation safety system that inhibits accelerator operation if a safety condition is not fulfilled, and a system that prevents hardware damage from uncontrolled beam.

Dedicated radiation sources will be developed, procured, and carefully adjusted. The baseline magnets include six 3.5 m-long wigglers, two elliptically polarized undulators, and four in-vacuum undulators, as well as one 3-pole wiggler.

Accelerator fabrication facilities will support the in-house quality control and assembly of the accelerator hardware components: magnet assembly and alignment facilities, vacuum assembly facility, pulsed magnet lab, accelerator survey lab, RF structure lab, and insertion device measurement lab. The design will support baseline parameters per the requirement document and will not preclude upgrade to a higher beam current of 500 mA.

1.03.01 Accelerator Systems Management -Oversee the design and development of the NSLS-II accelerator systems. Train and supervise personnel, carry out performance assessments, perform security and safety assessments, and recommend promotions. Monitor the design process, finalize the accelerator design, initiate studies of technical issues, carry out quality control, authorize changes, ensure reporting as required, assess vendors, and approve procurement. Organize meetings, distribute information, and follow up on issues and procedures. Provide a number of technical services:

- coordinate the storage ring and injector activities
- prepare installation planning and oversight
- ensure proper interfacing with conventional facilities and experimental facilities
- interface with the project support team to refine the schedule and cost planning

1.03.02 Accelerator Physics - Perform accelerator physics activities concerning aspects of the lattice, dynamic aperture, collective effects studies, injector system, RF-related effects, impedance calculations, stability issues, and parts of the controls software. There are a number of relevant tasks for defining the specifications of the accelerator components:

1. Accelerator lattice work: Lattice refinements, Correction System Definition+CorrSim, analysis of misalignment, distributing lattice info, build up and maintain lattice data base, insertion device matching
2. Dynamic aperture assurance: Sextupole optimization, parameter optimizations, tracking with errors (lin+MP), tracking with insertion devices, investigate MP-corrections, nonlinear analysis, documenting DA, improve DA analysis tools
3. Collective effects: Lifetime evaluation IBS, Single Bunch Inst. Ass. T, Single Bunch Inst. Ass.L, Coupl. Bunch Instab. Ass. T, Coupled Bunch Instab. L, T-Feedback design, L-Feedback design, Touschek-Lifetime calculations, Analysis of ion effects
4. Accelerator physics for injector: Beamline design, analysis of imperfections, booster injector/ejector design, refinement of injection in SR, top-off safety study
5. Miscellaneous accelerator physics: Efficiency study of scrapers and collies, pulsed magnet design, synchrotron radiation evaluation, development of beam diagnostics
6. RF-related effects: Beam-loading effect analysis, beam loading compensation, Landau-cavity analysis and design, document collective effects
7. Impedance assessment: build up and maintain impedance DB, RF measurements on critical components
8. Stability issues: Refine specs for diagnostic equipment, develop orbit feedback 0.01€"60 Hz, analyze instability sources

These tasks constitute a workload for 13 to 14 scientists over the project design and construction phase. Some of these tasks will lead to further activities in the project pre-ops (preparation for operations or commissioning) phase.

The priority of these tasks will partly depend on the outcome of the tasks themselves. The supporting documentation specifies the expected duration of the tasks; their link to other parts of the Project; milestones and deliverables; and time phasing of the work.

Note that most of the tasks need continuation beyond the design phase of the accelerator components, as it is expected that a number of accelerator components will be outside the tolerance window which requires studies into whether these components are acceptable. Thus accelerator physics tasks are part of the vendor-related risk mitigation strategy.

1.03.03 Injection System - Design, procure, assemble, install, test, and commission the NSLS-II injection system, which generates and accelerates an electron beam for subsequent injection into the storage ring. The injector system consists of an electron gun, a 200 MeV S-band linear accelerator (the linac), two transport lines (LtBR and BtSR), and the 3 GeV booster synchrotron. The linac system contains the gun, acceleration units, RF klystrons, amplifier stations, focusing, vacuum, diagnostics, and controls, and will be procured as a turn-key item. The booster is a 158 m-circumference compact synchrotron that will be a turn-key procurement. The transport line will be designed and build by NSLS-II with components procured in industry. WBS 1.3.3 includes the design, procurement, and installation of the NSLS-II injector. Injector integrated testing is in WBS 1.6.4.1.1. Injector commissioning is in 1.6.2.5.

1.03.04 Storage Ring - Perform all phases of design, procurement, subsystem testing, and installation of the storage ring system. The interface to the injector is at the entrance to the injection septum, while the shield wall is the boundary to the user program WBS. Insertion devices and all front-end components that are part of the Project scope are included within this element.

The storage ring is a 792 m-long synchrotron that consists of an injection section with four kicker magnets; a DC and a pulsed septum; the magnet system with 60 bending magnets, 300 quadrupole magnets, 300 sextupole magnets, and 210 horizontal/vertical corrector magnets; a girder system to support these magnets; a power supply system which provides the magnet currents for these magnets, plus 60 additional power supplies to be connected to 30 of the trim windings in the coils of the dipole magnets and 30 skew quadrupole trim magnets; approximately 792 m of aluminum vacuum chamber in 191 pieces with pumps; NEG-strips, flanges, bellows, gate valves, and diagnostics; a complete beam diagnostics system with 188 beam position monitors that constitute the heart of the diagnostic system; an RF system of one superconducting single cell 500 MHz cavity (a second cavity is procured as a special process spare, see 1.06.04), powered by a 300 kW turn-key procured klystron-based RF source as well as an 1500 MHz passive, superconducting Landau cavity; an electrical utility system that supports all these systems; a mechanical utility system in particular, a process and chilled water cooling system for cooling beam pipe and magnets; air conditioners for the power supply racks; and a cryogenic system for cooling the superconducting cavities.

1.03.05 Controls Systems - Design, specify and procure hardware and software for the global controls of the linac, booster ring, transport lines, storage ring, network, relational database, data archiving, machine protection, timing, fast feedback, and physics application support. See the level-4 and -5 entries for details regarding components.

1.03.06 Accelerator Safety Systems - Accelerator Safety systems provides personnel and equipment protection against hazards associated with routine and fault operation of the accelerators.

The Personnel Protection System (PPS) detects the state of equipment (accelerators, enclosures, shutters, and masks) to determine if operations of a particular accelerator will be permitted. It also detects faults

against permitted conditions and halts operation of a potential hazard source by redundant means. Design, prototype development, external review, fabrication, installation and testing of the PPS systems are included in the scope of the level-5 estimates below WBS 1.3.6.1.

The Equipment Protection System (EPS) monitors the state of systems that prevent the accelerator from damaging itself. For design, prototype development, external review, fabrication, installation and testing of the EPS systems, see WBS 1.3.6.2 and the level-5 entries below that.

Local shielding is provided to prohibit the development of unacceptable levels of radiation that might occur around shielding enclosure penetrations. The WBS 1.3.6.4 estimate includes only the estimated cost for the 15.8 cubic meters of lead shielding identified in the development of the specifications for the shields as part of the activities within WBS 1.1.2.2 (Shielding Analysis). The cost of the placement of the lead will be borne by the affected WBS elements (storage ring and beamline front ends). The costs for the required field verification of the placement of these shields has been estimated in the scope of WBS 1.1.2.2.

1.03.07 Insertion Devices - The Insertion Devices within this WBS element include all the costs associated with the design, R&D, procurement, assembly, and testing of the insertion devices.

1.03.08 Accelerator Fabrication Facilities - This WBS element includes all the activities in connection with accelerator fabrication facilities, needed to perform in-house assembly and adjustments of the components of the accelerator complex. These include the following:

- facility to measure the field quality of the storage ring (SR) magnets and to perform checks on conformity to the specifications, as well as to install and precision-align the SR magnets on the girder;
- facility to assemble the elements of the vacuum system and prepare them for installation;
- facility to assemble and adjust insertion devices, as well as measure and validate magnetic field properties;
- RF structures laboratory for the preparation and assembly of RF cavities prior to installation;
- laboratory for assembling and testing pulsed magnets; and
- laboratory for calibrating survey equipment .

Details on each of the fabrication facilities will be provided in the level-4 dictionary entries.

1.04 Experimental Facilities - Experimental Facilities includes all phases of specification, design, procurement, installation, and commissioning, without beam, of the six insertion device beamlines and instruments included in the Project scope. Also includes activities associated with planning the fully built-out facility, interacting with the user community, and accelerator and conventional facilities design.

1.04.01 Experimental Facilities Management - Oversight and management of the experimental facilities WBS scope, including specification, design, procurement, installation, and commissioning without beam of six insertion device beamlines, related activities associated with the engagement of the user community, and interface issues with accelerator systems and conventional facilities in the design of the facility for full build-out. Also includes management of R&D activities carried out in support of enabling the capability of this synchrotron facility to achieve ultimateperformance goals. This latter includes the 1 nm and 0.1 meV R&D programs, as well as the thermal management and beam position monitor effort.

1.04.02 Standard Local Controls and Data Acquisition Systems - Specify experimental requirements for network, computers, software, and hardware required to control the beamline transport components;

acquire data from transport components; and store and serve user database. Excludes design, procurement, and testing of prototypes, which are covered under WBS 1.3.5.7.

1.04.03 Standard Diagnostics - Design, analysis specification and tooling (if manufactured in house)of the beamline components common to more than one beamline that are used to measure properties of the beam, such as beam position, beam size, beam intensity or flux, and possibly beam polarization.

1.04.04 Standard Optics - Specify and design of standard optical components. Includes mirrors, filters, and monochromators. Does not include slits, apertures, or diagnostic components.

1.04.05 User Instruments - Specify, design, procurement, installation, and commissioning without beam of user beamlines involved in the Project scope. Includes effort involved in interactions with the user community, Accelerator Division, and Conventional Facilities.

1.04.06 Front End User Requirements Development - Define the technical requirements for the front end of each beamline. These requirements depend on the source, the beamline, and the user endstation.

1.04.07 Optics Labs - Specifying, fabricating, and testing optics for beamlines and instruments included in the Project scope.

1.05 Conventional Facilities - All phases of design, construction, and commissioning of the conventional facilities including the buildings, sitework, building services and utilities required to support installation and operation of the accelerator and experimental facilities. Buildings will include the Ring Building and associated service buildings, the entry Lobby, RF Building, Injection Building, three Lab-Office Buildings, and several utility enclosures.

1.05.01 Conventional Facilities Management - Level of Effort activity of the Conventional Facilities Director and CF support staff to manage the conventional facilities WBS scope.

1.05.02 Conventional Facilities Engineering and Design - Execution of engineering and design of NSLS-II buildings, utilities, and improvements to land by developing design requirements, preparing design drawings and specifications for construction contracts, and providing engineering support during the construction phase, to assure proper execution of the design and complete as-built documentation.

1.05.03 Conventional Facilities Construction - Construction of all NSLS-II buildings, utilities, and improvements to land, performed by multiple contractors. Building construction totals in a range of 500,000 to 600,000 GSF of programmatic buildings plus some utility enclosures. Buildings will include an approximate 400,000 SF Ring Building;, two 40,000 SF Lab-Office Buildings fully fitted out; and one 40,000 SF Lab-Office Building fully enclosed with basic utility services, heating, and fire protection but not interior fit-out. Also included are utility enclosures for RF support equipment, cooling tower pumps, and electrical gear. Utilities will include connection to existing central utility services for chilled water, steam and condensate, electrical power, data and communications, potable water, stormwater, Process cooling water, and sanitary systems. Improvements to land include site clearing, excavation, drainage, and erosion control; the installation of roadways, parking and sidewalks; and revegetation of the site to pentants 1 and 5 and partially in pentants 2 and 4. The Ring Building is the functional center of the facility and is the primary element of the Ring Building contract.

1.05.04 Integrated Controls and Communications - Procurement and installation of Integrated Controls and Communications including the communication infrastructure needed to supply the accelerator control system (EPICS) with information about the status of CF systems such as HVAC,

Chilled Water, DI Water Tower Water, etc. It includes all interface and networking devices to enable communication between the building management systems Automated Logic hardware and the EPICS network. It will be performed by Project staff in concert with small installation contracts.

1.05.05 Standard Equipment - Procurement and installation of Standard Equipment including office and laboratory furnishings and general office equipment. These will be provided through several furnish-and-install contracts.

1.05.06 Conventional Facilities Commissioning - Commissioning will be performed by a Commissioning Contractor and includes inspection, calibration, start-up, test, and acceptance of all conventional building systems to assure readiness for beneficial occupancy. Also includes preparation of O&M documentation and training of O&M staff.

1.06 Pre-Operations - Support for the transition to operations of subsystems that have completed commissioning. by providing support for the cost of refinement of operation configurations of component systems prior to full facility operations.

1.06.01 Management - Pre Ops - Management of all Pre-operations activities including producing a transition plan for moving operations from NSLS to NSLS-II configuration.

1.06.02 Accelerator Systems - Pre-Ops - This summary WBS item contains the effort required to accomplish the transition from construction phase to operating the accelerator. In particular, it captures the integrated testing of the accelerator systems after the single systems have been completed and tested in standalone mode. It also includes the preparation of the procedures, algorithms, and detailed plans for commissioning the accelerators with beam. The commissioning process for accelerator systems also is captured under this WBS.

1.06.03 Experimental Facilities - Pre Ops - Perform pre-operations activities required to accomplish the transition from construction phase to operating the beamlines. It captures the integrated testing and alignment of hutches, optics, beam transport components, beamline control systems, the EPS, PPS, and connections to utilities and communications.

1.06.04 Spares - Define and procure Special Process to assure the continuity of operation of equipment and facilities. Special Process Spares meets the following criteria:

- It is a component in itself, which performs a specific function.
- Its acquisition value is $1,000 or more, and it is used to replace a similar component of a retirement unit.
- It is vital to the maintenance of continued operation.
- It requires a long lead-time in manufacture and delivery.
- Uncertainty exists as to the useful life of the operating unit.

Special process spares include:

- RF Cavity
- Booster Main Power Supply
- Klystron
- SCC Cavity
- Storage Ring Magnets

A full spares list can be found in the backup documentation associated with this WBS element.